FLIGHT and AIRCRAFT ENGINEER

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FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams : Flightpres, Sedist, London. Telephone : Waterloo 3333 (50 lines.)

COVENTRY : 8 - 10, CORPORATION ST. Telegrams : Autocar, Coventry. Telephone : Coventry 5210.
BIRMINGHAM, 2 : KING EDWARD HOUSE, NEW STREET. Telegrams : Autopress, Birmingham. Telephone : Midland 7191 (7 lines).
MANCHESTER, 3 : 260, DEANSGATE. Telegrams : Iliffe, Manchester. Telephone : Blackfriars 4412.
GLASGOW, C.2 : 26B, RENFIELD ST. Telegrams : Iliffe, Glasgow. Telephone : Central 4857

SUBSCRIPTION RATES : Home and Abroad : Year, £3 1 0. 6 months, £1 10 6.

Registered at the G.P.O. as a Newspaper

No. 1983. Vol. L December 26th, 1946 Thursdays, One Shilling.

The Outlook

The New Aviation Centre

BRITISH aviation owes much to the Marquess of Londonderry. From the time he became Under-Secretary of State for Air in the Coalition Government in 1920 (when Mr. Churchill combined the portfolios for War and Air) he has taken the very keenest interest in air matters. During his period in office as Secretary of State for Air, which began in 1931, he had a difficult task, for his colleagues in the Cabinet were frankly not very air-conscious. Had he received more support from them he would undoubtedly have accomplished more than he did. But economy was the order of the day, and the R.A.F. was made to contribute more than its fair share. That was no fault of Lord Londonderry's, who fought hard against the reductions, although the fact was not generally known at the time.

Between the wars Lord Londonderry worked hard for aviation, partly behind the scenes but also openly in the House of Lords. And in quite recent times he became a thorn in the side of the Government by his insistence that a civil aviation policy was long overdue. When the Government would have preferred conveniently to forget about post-war civil aviation, he kept worrying them, until at last Lord Swinton was appointed the first Minister of Civil Aviation.

And now Lord Londonderry has again demonstrated his interest in aviation—and in a very practical way—by letting to the Royal Aero Club for a period of 21 years at a purely nominal rental Londonderry House in Park Lane. Not only so, but much of his furniture and many of his valuable pictures will go with the premises, which will thus become a fitting home for the new Aviation Centre of Information. The centre will in no way clash with the activities of the Royal Aeronautical Society, which is and will remain the focus of technical matters. The new centre will deal with the sporting and touring side, and will also offer office accommodation to such bodies as the Association of British Aero Clubs, the British Gliding Association, the Aerodrome Owners' Association, the British Air Charter Association, and the Guild of Air Pilots and Navigators.

Spitfire Saga

"THERE is little doubt that the chief reason for the continued success of the Spitfire was the progressive increase in speed, from 362 m.p.h. on the Mark I to the 450 m.p.h. on the Mark 24, and its rate of climb from 2,500 to 4,800 feet per minute." Thus Mr. Joe Smith, Supermarine chief designer, in his paper "The Development of the Spitfire and Seafire," read before the Royal Aeronautical Society on December 19th. The paper was devoted to explaining just how these amazing results were achieved, and outlining the changes which made them possible. They are summarized elsewhere in this issue.

Mr. Smith might well have claimed most of the credit for himself and his team, but he repeatedly paid tribute to the others who had contributed, notably Rolls-Royce, Ltd., for the development of the engines from the 1,050 h.p. Merlin in the Mark I Spitfire to the 2,350 h.p. of the Griffon in the Seafire 47, the last of the "line." The airscrew manufacturers, too, were given full marks for their share in the success. All this was so very characteristic of Mr. Smith, who has always shunned the limelight, and the world owes gratitude to whoever it was that persuaded him to come out of hiding to read this paper, which gave, for the first time, a coherent picture of an evolution without parallel in the history of aviation. And no one else could have been in possession of all the facts needed to tell the story in detail.

It is so very easy to dismiss the whole history, as some have been inclined to do, by arguing that it was the Rolls-Royce company which provided the extra power, and that all the aircraft team had to do was to strengthen the structure from time to time sufficiently to take the greater loads imposed by the fitting of more

and ever more powerful engines. Certainly the performance could not have been achieved without this extra power, but there was, of course, much more to worry the airframe designers than mere stiffening-up here and there.

There was, for instance, the question of absorbing efficiently the greater power, a problem which the airscrew manufacturers solved very successfully. But then there were the problems of stability and control becoming more and more critical as speeds increased. Concurrently the number and size of guns and ammunition kept changing and increasing, and space had to be found for this, as well as for the extra fuel consumed by the more powerful engines. The introduction of the Seafire brought further complications in the form of folding wings, arrester hooks and all the other special equipment demanded by the Navy. And, let it be remembered, all this had to be attained without interfering too much with rate of production.

That the amazing success was achieved is to the great credit of the design team which, as Mr. Smith pointed out, worked continuously over a period of ten years on the improvement of a type which they had originated, initially, under the late Mr. R. J. Mitchell. It speaks volumes for his foresight that the original conception and basic design were not altered fundamentally in the course of all this development, in spite of the fact that altogether some 22,000 machines were built, representing no fewer than 33 different types.

The experience of high-speed design began, of course, with the Schneider Trophy seaplanes, the earlier ones of which were built as private ventures by the late Commander James Bird, without any help from the Government. Mr. Smith put it very succinctly in his paper when he said: "There is no doubt that very valuable experience had been gained from the design and manufacture of these racing aeroplanes, and this resulted in a team whose outlook was essentially speed conscious, and who thought of drag reduction in terms of small size, thin wings and aerodynamic cleanliness."

There is profound wisdom in those three words *essentially speed conscious,* and there is no doubt that much of the ensuing success is due to that speed consciousness.

A team which possesses it will instinctively avoid even minor protruberances, and in the case of the Spitfire such cleaning-up of apparently minor items resulted in a speed increase of something like 40 m.p.h.

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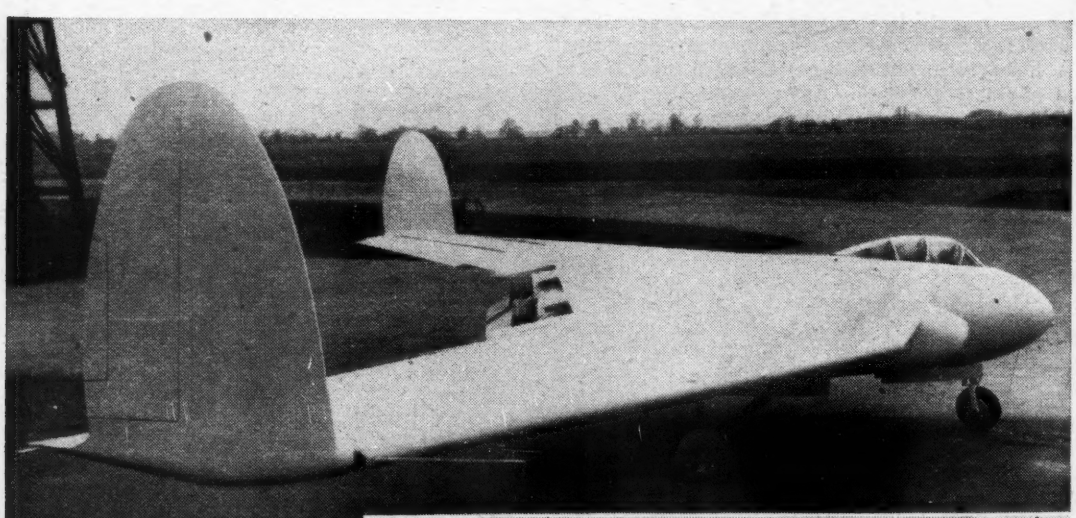


MODERN MERCURY: Soon to make its first flight, the tailless A.W.52 experimental mail-carrying aircraft (described in detail in last week's *Flight*) is one of the world's most advanced designs. Pure jet powered by two Rolls-Royce Nenes, it may be as much as 100 m.p.h. faster than any other aircraft of its size. The span is 90 ft, the weight 32,700 lb. Inset (left to right) are T. O. M. Sopwith, Sqn. Ldr. E. G. Franklin (test pilot), John Lloyd (Chief Designer), and Sir Ben Lockspeiser.

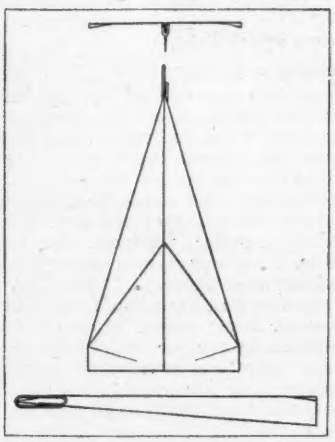
PROSPECTS and PORTENTS

Resumé of a Lecture by Dr. A. M. Spüffing, Professor of Aerodynamics at the Montgolfier Institute : Interesting All-wing Research : "Boomerang" Airliner Project

OPENING his address,* Dr. Spüffing remarked that it had been made clear, through the most careful extrapolation of graphs and through a prolonged study of present-day trends by his colleagues and himself, that aircraft speeds were tending to show a rise, and that this rise was likely to continue in future years. In his experiments he had, however, reached conclusions which had not, so far, been generally accepted.

First, that there appeared to be an unaccountable rise in air-resistance, or drag, as speeds increased ; secondly, that turbulence in the atmosphere might, at high speeds, cause considerable stresses in both airframe and human structures, so that it would obviously be necessary to stiffen up these considerably ; and, thirdly, that, although conditions at high altitudes were likely to be less turbulent, it would consequently be necessary to provide some means of offering more air and/or oxygen for the consumption of the occupants of the aerodyne concerned. He went on to stress the fact that structural, physiological and pressurization problems would need to be tackled with great energy if the difficulties concerned were to be overcome in time for the various aircraft to be in service on the dates promised by so many well-informed writers — who were, after all, the foremost arbiters of future design and development.

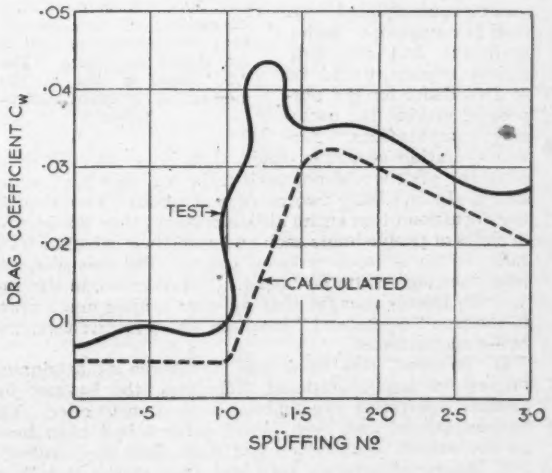
OLDER readers may remember the name of Dr. Spüffing in connection with his important work on ornithopter design development during the earlier part of this century. Since that time he has been primarily concerned with research in rather a different sphere—that of finance and, consequently, of the diversion of otherwise frozen assets into useful circulation—but he has recently returned to his old interest, and for the past two years or more has been at work in the aerodynamics laboratory of the Montgolfier Institute, Wormwood Scrubs. In the following summary, "Indicator," who attended the lecture, has endeavoured to give the essential features of the Doctor's discourse.



Interesting all-wing 'Spearhead" model on which wind-tunnel tests were made. Note the "stability retainer" in the nose.

Whilst he did not agree with the late Doctor Johnson in the latter's theory that the human frame would be fatally exhausted if subjected to any speed in excess of 20 m.p.h., he felt that, on the other hand and if he might be allowed to use the vernacular, his contemporary, Doctor Mach, "had something." What that "something" was remained to be seen. He thought it probable that aeronauts, whether at the controls or merely travelling as ballast, would find it necessary to hold tightly on to their hats when passing through the speed of sound—at which, according to his calculations, the "Spüffing Number" would be unity and the airflow movements largely unpredictable. (At this point the lecturer outlined the methods he had used in his calculations and the formulæ on which he had based them. He also explained the Spüffing Number. These explanations will be somewhat too abstruse for the ordinary reader, who would be advised, if interested, to obtain a copy of *Aerodynamic Considerations with Particular Reference to Shock Waves, Shop Stewards and Shop Lifting* from H.M. Stationery Office, price 2d. However, it might briefly be said that the entire situation is based on the comparatively simple aerodynamic formula: $\frac{S_{KF} \times \sqrt{V_b}}{PD_4} = \sqrt{\frac{SC_L}{\pi_x}}$ in which S is the Spüffing Number.)

Turning to the more directly practical work of the Institute, the Doctor explained how, during the past year, he and his colleagues had carried out a series of experiments using models of an unusual layout and method of construction. This layout, he thought, might be applicable to large-scale aircraft, and the constructional principles might greatly decrease the present costs of aircraft production. The material he used consisted of sheets of a form of bleached wood-pulp, with a high yeast content and consequently polished and stiffened form ; whether these sheets were ruled or plain was immaterial. Each was folded and refolded with the help of a specially designed apparatus made by the Institute research personnel, so that a finished model could be produced without cutting, riveting, or other skilled work. The model was, in general appearance, a much-improved version of the all-wing Lippisch P-13. However, in the Spüffing S-427, as the model has been designated, the sweep-back was much more considerable, and the built-in "keel" provided directional



Drag of the S-427 aerofoil at high Spüffing numbers. The variations in the test figures were caused by distortions of the structure.

(* Delivered before the Arts and Science Society, Wormwood Scrubs.)

PROSPECTS and PORTENTS

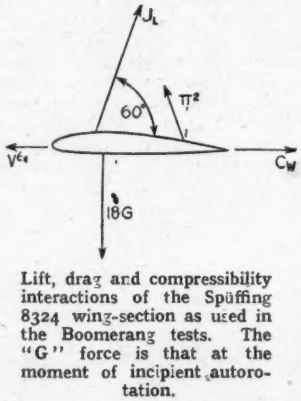
stability without the necessity for any additional fin-area. (The S-427 is shown in the general arrangement drawing on the previous page.)

Several models had been made and some very interesting experimental results had been obtained. At the moment, said Dr. Spüffing, an improved model was actually being tested in the high-speed wind-tunnel at Farnborough and some confirmatory data was already available to support his original claims. These were, briefly, that the low-speed control problems were likely to be very much less involved than in the case of aircraft of more normal aspect-ratio, and that the tip-stalling difficulty disappeared when this ratio was reduced below a figure of approximately 1.825. (Its drag, in ratio to the Spüffing Number, was shown in a graph on an accompanying slide. From this it was seen that the estimated maximum drag coefficient in the transonic region was 0.0342—an exceedingly low figure, and one comparing favourably with that of the majority of conventional types flying at speeds well below Spüffing unity.)

Rigid Stability

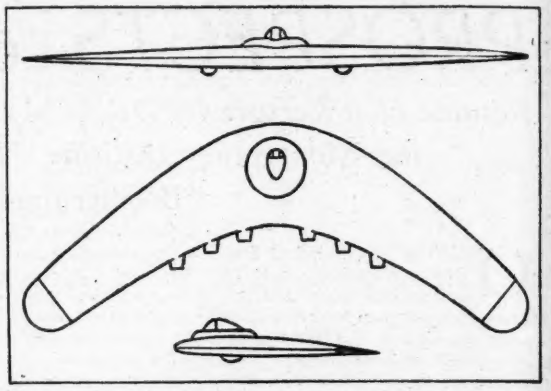
Longitudinal stability had been found to be exceptionally good with the S-427—so much so, that, especially at transonic speeds, it might be necessary, the lecturer thought, to add stability-spoilers, and he was now at work on the design of these appendages. So far, no means of providing lateral control had been found necessary; the model showed no sign of dropping a "wing" since there was virtually no wing to drop, and it appeared to fly equally well either way up. For the comfort of crew and passengers, however, he suggested the use of gyroscopically stabilized and universally mounted "inner" cabin which could float freely within the V-section structure of the keel.

Directional stability, too, had been found to be excessive to the point of rigidity. With any full-scale version it was proposed that no attempt should be made to modify this condition, but that the aircraft should be launched from a catapult, the rails of which were already arranged to point in the correct direction for the particular airline service contemplated. A staff of navigators, mathematicians and meterorological experts would be in attendance for the purpose of making the necessary computations. Airline operating economy would thus be greatly increased since the pilot would not need to be a highly paid professional. In fact, only two navigators would be required for the operation of an entire airline system; they would work in shifts of twelve hours each and send their calculations by radio to the different take-off points. But this was, perhaps, looking a little far ahead. Nevertheless, in this project the Doctor thought that we were coming much nearer to the true "Spearhead" ideal, on which research was now being concentrated.



Lift, drag and compressibility interactions of the Spüffing 8324 wing-section as used in the Boomerang tests. The "G" force is that at the moment of incipient autorotation.

If, however, this ideal was impossible of attainment because of any operational difficulties, the lecturer had another interesting and unusual suggestion to offer. This unconventional and even heroic project had been based on the patient work which had been done by Leadbetter and Brazenose between 1919 and 1942 at the R.A.E. on the autorotative characteristics of an F.E.2b with varying incidences and tailplane settings. The work was still incomplete, since the Establishment had unfortunately run out of its supply of F.E. airframes. But the unremitting efforts of these two explorers of the ultimate aerodynamic truth had shown that, if c.p. and c.g. travels could be completely restricted, autorotation was not experienced, and that, conversely, a positively arranged c.p. travel, coupled with a considerable rearward movement of the c.g., produced a very stable, smooth and rapid rotary motion.



Projected "Boomerang" airliner developed as a direct result of the work of Leadbetter and Brazenose.

This interesting discovery led Doctor Spüffing to the view that, since spinning was a comparatively stable and even final aerodynamic condition, it might be advisable for an aircraft to *start and to continue* its flight in this condition. From this view it was a very short intellectual passage to the Doctor's eventual project—that an aircraft should be designed on the "boomerang" principle. Not only would such a machine be quite stable in its movements, but, by a suitable adjustment of asymmetric thrust from the jet units, it could be made to return accurately to its point of take-off when and if bad weather prevented the normal continuation of the flight.

Automatic Reciprocals

Experiments with models showed that the well-known "boomerang" effect was the result of very simple aerodynamic causes. In brief, the boomerang, being in fact two aerofoil surfaces, had return-flight characteristics which were determined by the inter-action between the c.p. travel of each "wing," this inter-action having a lateral component of lift which caused the aircraft as a whole to describe a helical path. Obviously, the actual path could be varied by the use of asymmetric application of power at a predetermined moment. Normally the thrust would be arranged so that the aircraft would travel on a Great Circle course, any reversal, of course, being obtained by augmentation on one side and by the use of Spüffing lift-spoilers. Again, a gyroscopically stabilized cabin would be necessary, this being free to rotate in the structure. A compass-controlled gyro would provide the main control for this cabin.

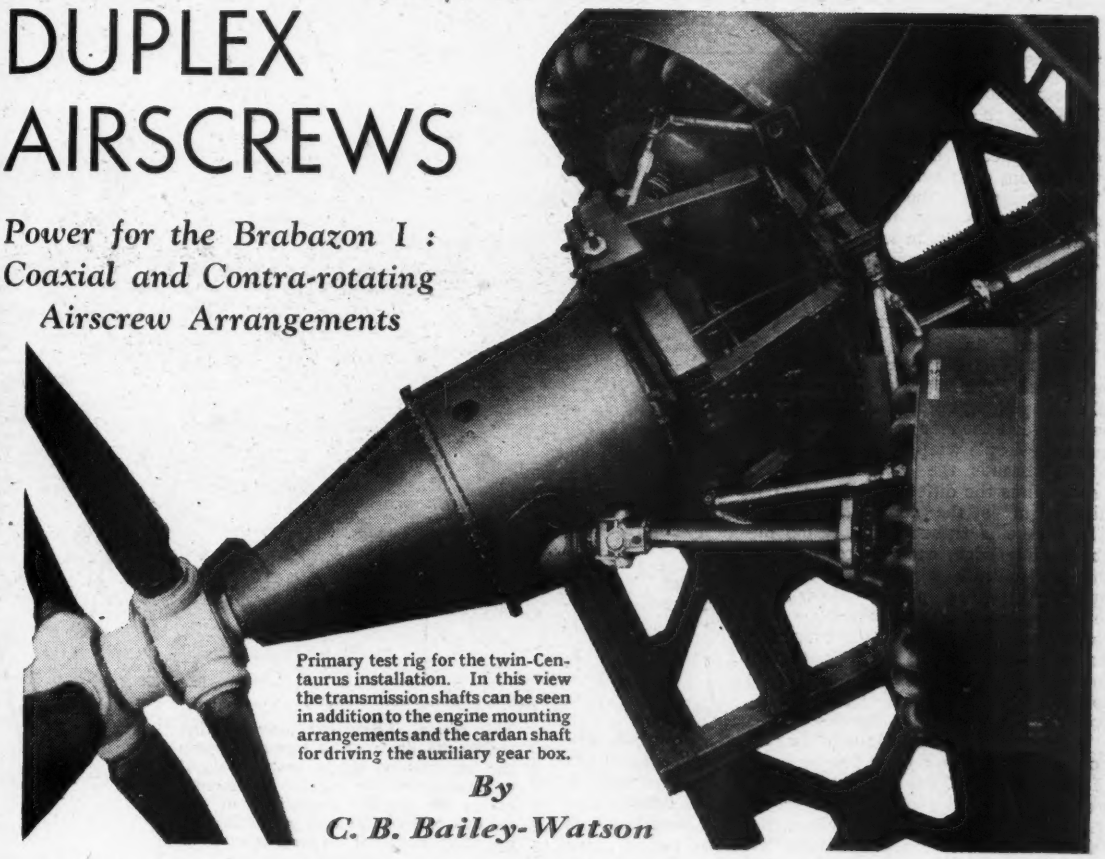
[Owing to pressure on space, our paper ration for this year having come to an end, the publication of the remainder of Dr. Spüffing's interesting lecture has had to be indefinitely postponed.—ED.]

FORTHCOMING EVENTS

Jan. 3rd.—I.Mech.E.: "The Development of Aircraft Hydraulic Machinery," H. G. Conway, S. M. Parker, and D. A. L. Robson.
Jan. 4th.—R.Ae.S. Reading: Annual general meeting.
Jan. 4th.—British Interplanetary Society: "The Energy and Stability of Atomic Nuclei," L. R. Shepherd.
Jan. 6th.—R.Ae.S. Medway: "Design of a Two-seater Sailplane," F. M. Reynolds.
Jan. 7th.—R.Ae.S. Belfast: "Gliding," Professor Hill.
Jan. 7th.—R.Ae.S. Bristol: Brains Trust, with Capt. J. Laurence Pritchard as Question-master.
Jan. 8th.—R.Ae.S. Southampton: "Elementary Metallurgy of Aircraft Materials," A. Black.
Jan. 9th.—"Aerotech" Flying Club, No. 1: "World Gliding," Flt. Lt. Vernon Blunt.

DUPLEX AIRSCREWS

Power for the Brabazon I : Coaxial and Contra-rotating Airscrew Arrangements



Primary test rig for the twin-Centaurus installation. In this view the transmission shafts can be seen in addition to the engine mounting arrangements and the cardan shaft for driving the auxiliary gear box.

By

C. B. Bailey-Watson

BEFORE we start to unravel the various skeins of the Brabazon I power installation, we might with advantage first take time to define the difference between contra-rotating and coaxial airscrew designs. Although at first this would appear to be somewhat difficult since coaxial airscrews contra-rotate and, equally, contra-rotating airscrews are mounted coaxially, in point of fact it is reasonably simple. The accepted basic definition is that co-axial airscrews are *entirely separate airscrews* mounted on co-axial shafts each driven by its own engine, usually through reduction gears in a common box. A contra-rotating airscrew is a *single airscrew* unit of two blade banks mounted on co-axial shafts driven by one or more engines—usually the former. So much for terminology.

In passing, it might be noted that since a contra-rotater is a two-bank single unit airscrew, the singular case is used, i.e., one refers to a contra-rotating "airscrew," but in the complementary application of coaxial airscrews, as each bank of blades is a separate airscrew driven by its own engine, the plural is used and the term is thus coaxial "airscrews."

Very briefly, and in the most general sense, the prototype Bristol 167 power installation can be said to comprise four pairs of Centaurus engines, the individual units of each pair being angularly disposed one to the other so that their crankshaft axes centre at a vertex angle of 64 degrees. The crankshafts drive torsion shafts which, in turn, drive bevel pinions meshing with bevel wheels carried on the respective airscrew shafts. The latter are nested coaxially, the outer shaft carrying and driving the rear airscrew and the inner shaft carrying and driving the front airscrew.

This arrangement, finally adopted after every other alternative had been the subject of intensive design study is, in fact, the simplest of all, involving as it does the use of only a single pair of gears (the reduction bevels) for each engine/airscrew drive, thus incurring the lowest possible transmission loss penalty. The target mechanical efficiency was 99.3 per cent—an inordinately high one—but Bristols have the great satisfaction of having proved that, to judge by the considerable running tests so far done, the drop in efficiency actually encountered is satisfyingly less than that estimated in assessing the target figure.

Viewing the power installation as an overall problem one may appreciate the enormous amount of work entailed by considering a typical example. The size of the bevel wheels in conjunction with certain unusual design features and the degree of accuracy required were quite outside the capacity of any gear generating machines known to exist. To overcome the difficulty Bristols made a close study of the problem, found a solution, and put up the proposal to David Brown and Sons, Ltd., who agreed to undertake manufacture. Special equipment was designed and built, and the gears produced. In essence one can sum up the main problem as being one involving the reorientation and scaling-up in size of conventional elements; most of the difficulties incurred being concerned with refining and simplification of design, together with maintenance of efficiency in the increased sizes rather than difficulties of actual planning design as such.

THIS article forms the first section of a review dealing with coaxial and contra-rotating airscrew drives. A coaxial arrangement is dealt with this week, and a contra-rotating design will be included in next week's issue.

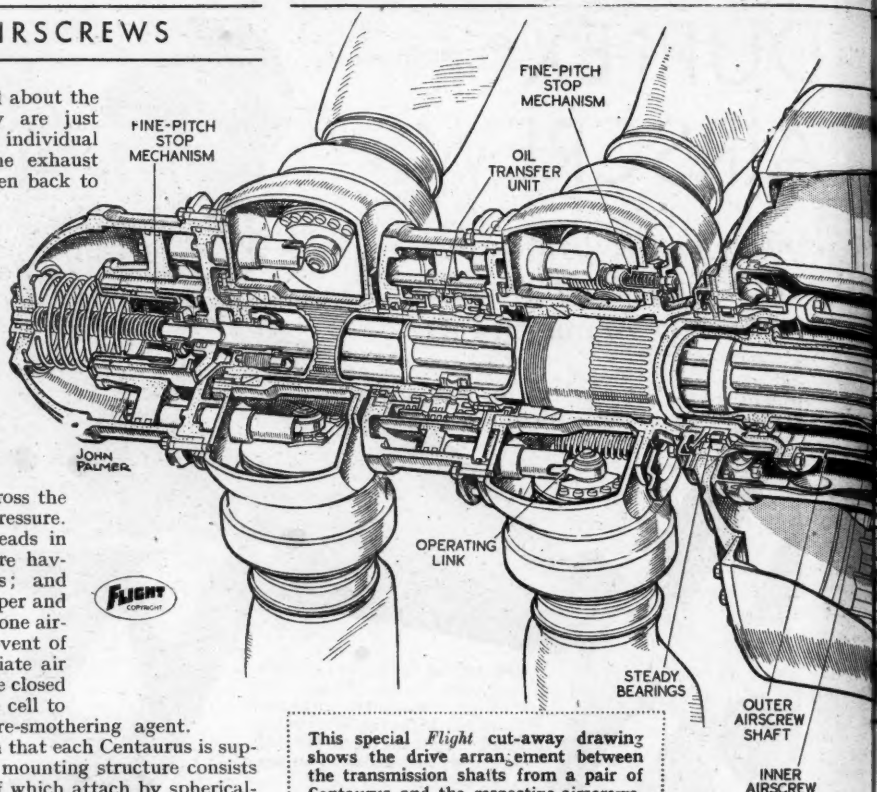
As representative of the coaxial layout, we have selected the power installation of the Bristol 167, and by so doing serve a double purpose, for not only is it an excellent example of the type of engine/airscrew drive we wish to consider, but at the same time it is topical and of interest in itself as part of a great project.

DUPLEX AIRSCREWS

There is nothing exceptional about the Centaurus themselves. They are just standard Mk 57 units without individual reduction gears, but with the exhaust stacks from each cylinder taken back to "half-horseshoe" manifolds, air-muffed for heat insulation, which terminate in discharge elbows protruding beneath the skin line of the lower wing surface. In this guise the engines are termed Centaurus XXs.

Each engine is housed in a sealed cell divided by a diaphragm picking-up to a sealing sleeve at the rear extremities of a simple wrapper cowl which shrouds the cylinder heads; thus the differential across the diaphragm is the cooling pressure. The intake is through ram heads in the leading edge, each aperture having horizontally hinged flaps; and outlet is via gill slots in the upper and lower engine cell doors. When one airscrew is feathered—or in the event of fire in an engine—the appropriate air intake flaps and exit gills can be closed to reduce drag and/or seal the cell to preclude dissipation of the fire-smothering agent.

Engine mounting is unique in that each Centaurus is supported on one side only. The mounting structure consists of two "tripods" the apices of which attach by spherical-seat quick-release couplings to the wing structure, whilst the base of each tripod leg anchors to attachment brackets on the crankcase. In conjunction with the tripods, two stabilizing struts form a forward extending vee in the vertical plane.



This special *Flight* cut-away drawing shows the drive arrangement between the transmission shafts from a pair of Centaurus and the respective airscrews, giving the relative disposition of the various components and permitting the operative motion of the mechanism to be grasped.

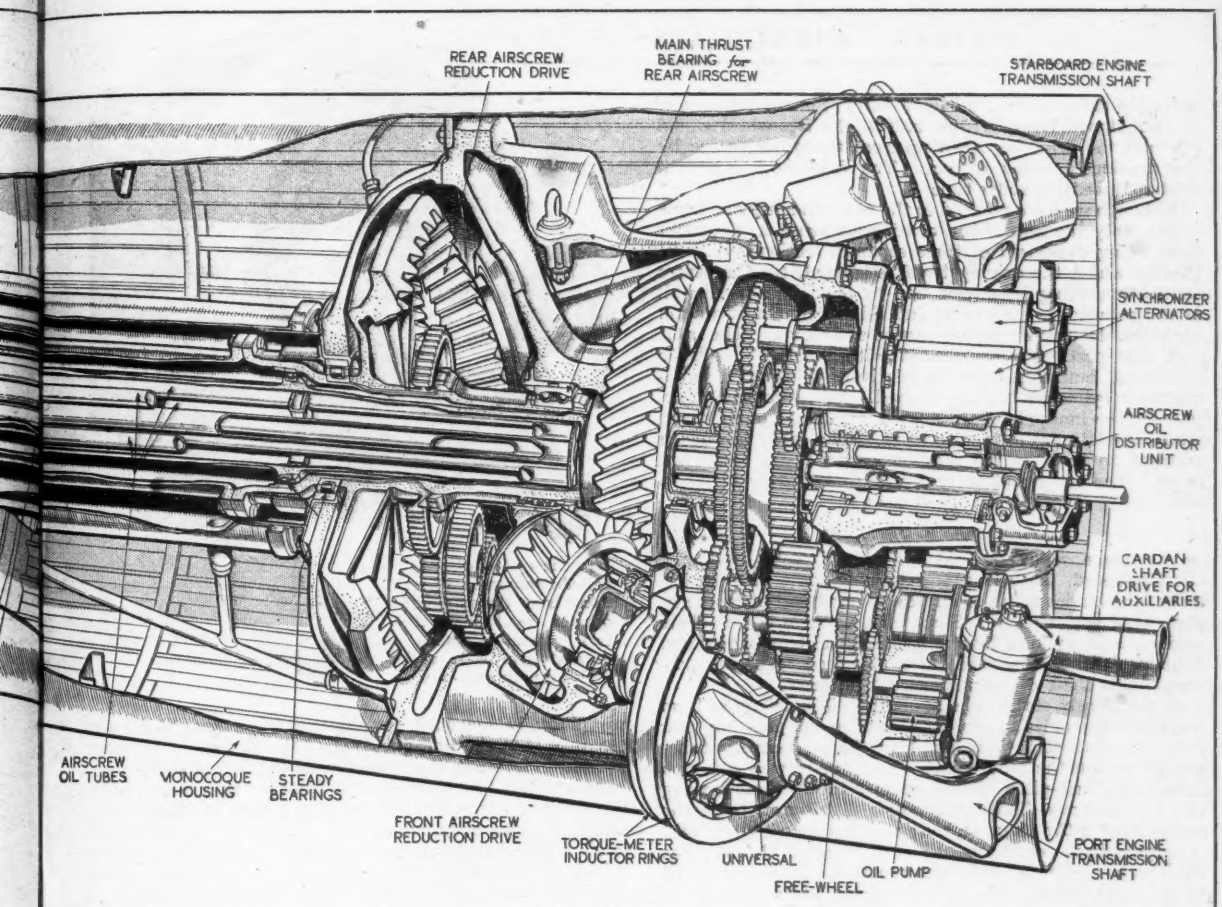
Gear box Details

The power input into each gear box is made by transmission shafts joined to the respective Centaurus crankshaft flanges through the medium of Layrub flexible couplings, and transmitting through Hooke-type universal joints into the gear box. Inductor-rings for electric torque-meters are conveniently arranged around the universals.

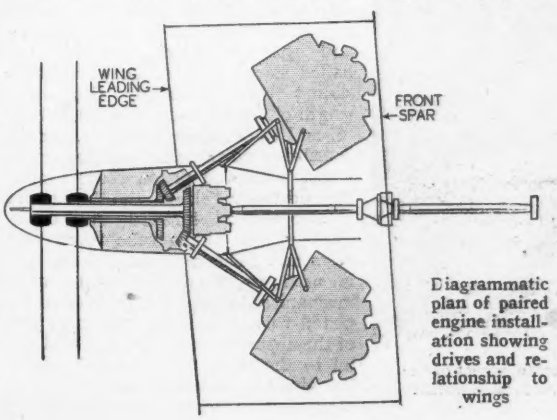
To consider the gear box itself: the casing is formed in four sections, all of cast magnesium alloy. They are (i) the front cover, (ii) the main casing, (iii) the auxiliary drive casing, and (iv) the rear cover. Mounting is through the main casing, which is circumferentially bolted to a mounting ring built integrally with the monocoque truncated-cone housing which, in turn, is anchored to the wing structure. This monocoque carries not only the dead weight of the airscrews, but also supports any dynamic out-of-balance forces of airscrew rotation, in addition to being, via the gear box, the main thrust transmission member between airscrews and airframe.

Starting from the back and working forward, the gear box rear cover and auxiliary drive casing support between them a series of gear trains which drive the synchronizers, airscrew controllers, gear pumps, and auxiliary gear box drive. In the rear cover itself is housed the airscrew oil distributor-unit by means of which control oil delivered from the controller units is transferred to the appropriate tubes for supply to the airscrew actuating cylinders. These tubes, two to each airscrew, are radially disposed about a common axis and are housed within the inner airscrew shaft.

This full-size test rig is a mock-up wing section of the 167 housing one of the twin-Centaurus power installations. The photograph shows the air-intake ram-heads and gives a good idea of the aerodynamic cleanliness.



The auxiliary drive casing carries the roller bearing in which the rear spiral bevel wheel is mounted on the inner airscrew shaft. Immediately forward of the rear bevel is a duplex roller and ball bearing for journal and thrust loads of the inner shaft. These bearings are supported in the rearmost part of the main casing (which is in the form of a double-walled cone), and housed in front of them is a double-row ball bearing acting as the main thrust and tail-support bearing for the outer airscrew shaft. An interesting design aspect of the gear box is that all major loads are focused at a single point on the airscrew shafts' axis, the shaft bearings and cone apices of the main casing diaphragms centering as close to this point as possible. The front bevel is of internal straight-tooth type and, like the rear wheel, is splined to its airscrew shaft. Both bevel pinions are splined to input shafts carried in roller and ball bearings, the shafts taking the drive from the universal joints on the transmission shafts.



Diagrammatic plan of paired engine installation showing drives and relationship to wings

Bevel Drive Cooling

Obviously the heat generated in the bevel meshing zones will be very great, considering the power being transmitted, and to effect cooling clustered oil jets are set on the "downstream" side of the meshing zones, discharging directly down the tooth flanks. Since the tooth-face temperature-rise will be at its peak immediately after meshing, this is the logical spot to apply coolant. It will be obvious that most of the heat is at the surface whence it is most easily abstracted by the oil. Cooling-oil flow-rate is approximately 300 gall/hr and is delivered by the gear pump in the rear cover. Whilst on the subject we may note that oil is fed from an outside tank and cooler to the suction side of the pressure pump, passes through the pump and thence through a Purolater pressure filter, and so into the gear box. Total flow-rate is about 330 gall/hr, of which roughly 30 gall/hr is for lubrication. The oil is a low viscosity type with special additives for specific use with gears of high tooth pressures.

Drive is taken from the gear box through a dual free-wheel system to the aircraft auxiliaries gear box mounted back in the wing and remotely driven through two cardan shafts with Layrub couplings. The auxiliaries are powered from the reduction gear box in such a way that, should one engine fail, the drive will be maintained. This is achieved by taking a drive from each airscrew drive via a twin free-wheel device. The drive is so arranged that there is a slight r.p.m. difference as between the input drives to the free-wheels with engines synchronized, and thus the drive is

DUPLEX AIRSCREWS

normally taken from one engine only. Should this engine be shut down, however, one half of the free-wheel would idle and the drive be taken up from the other engine by the previously idling section. The free-wheel is a conventional wedging-roller type.

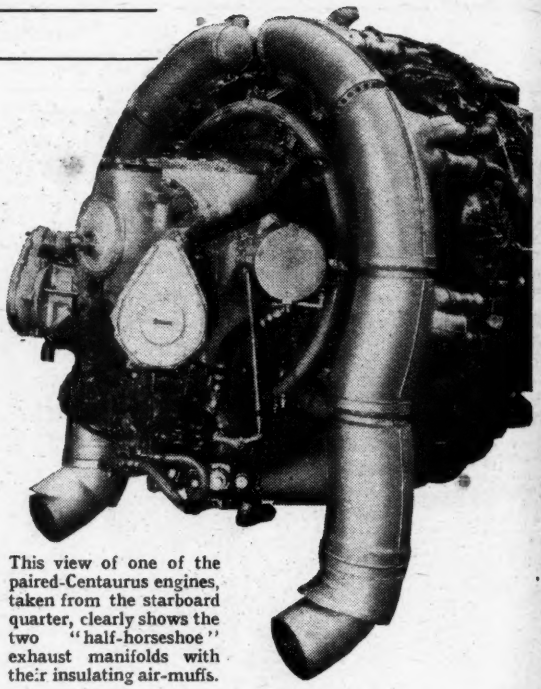
Although we have referred to the inner and outer airscrew shafts, only the former is a continuous member, the outer shaft being composed of three separate sections, viz.: (i) that to which the driving bevel is splined, (ii) the centre section extending from gear box to the forward end-wall of the monocoque structure; and (iii) the foremost section on which the rear airscrew is carried and driven. The front and rear portions are arranged with "belled" ends to which the central portion—a relatively thin-walled large-diameter cylinder—is flange-bolted. Roller journal bearings for the inner shaft are housed within the outer shaft, whilst the latter is in turn supported by a roller bearing in addition to those in the gear box main casing and front cover. The inner and outer shafts are respectively No. 6 and No. 7½ S.B.A.C. standard sizes.

Airscrew Operation

The airscrews are special three-blade Rotol hydraulic constant-speed, feathering and braking units of 16ft diameter, the blades being of improved-wood and of Hordern-Richmond manufacture. Since each airscrew is a separate entity, it is obvious that the rear airscrew's piston and cylinder assembly must be of annular form to permit passage of the shaft carrying the front airscrew.

As previously stated, the actuating oil is delivered from the controller units to the distributor in the gear box rear cover, whence it is transferred to the oil delivery tubes housed within the inner shaft. Each airscrew is fed with fine- and coarse-pitch oil by separate tubes, those serving the rear airscrew discharging into a distributor inside the inner shaft (the front airscrew tubes passing straight through), from which the oil is transferred through the shaft wall. On emergence from the shaft the oil is directed to the appropriate side of the annular piston through a further distributor enclosed by a sleeve on which the piston slides. The enclosing cylinder is flange-bolted to the airscrew hub, and at its forward end it carries a roller bearing which supports the inner shaft.

Pressure oil feed to one side or other of the piston causes it to slide in the cylinder, and eyebolts, bolted to the piston, are pivotally attached to offset pins on the blade-root bases, so that the linear motion of the piston is converted to rotary motion of the blades to effect pitch change.

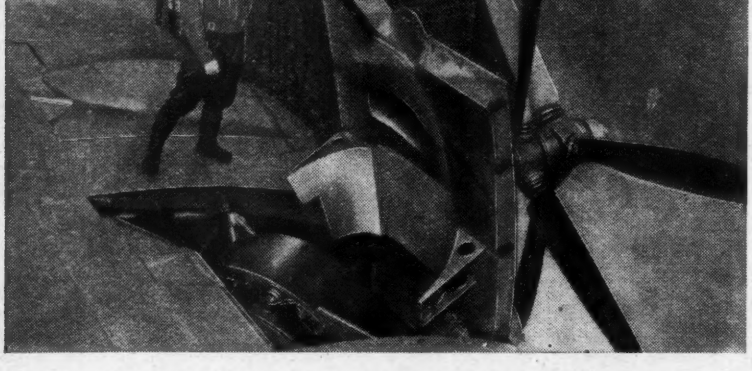


This view of one of the paired-Centaurus engines, taken from the starboard quarter, clearly shows the two "half-horseshoe" exhaust manifolds with their insulating air-muffs.

In structure and operation the front airscrew is similar to the rear unit, excepting the cylinder which, of course, does not need to be of annular form. However, the front airscrew's piston is annular since the central part of the cylinder is taken up by the fine-pitch stop mechanism, the piston sliding on a sleeve bolted to the cylinder base.

Normally the fine-pitch stop is a positive mechanical type of abutment, but in this case, where the blades have to turn through fine pitch in order to give negative thrust for braking, no form of positive fixed stop can be employed. Nevertheless, a fine-pitch stop of some sort has to be embodied, and the way in which this has been achieved is quite interesting.

The piston travels forward for fine-pitch blade motion and, as it approaches the fine-pitch limit, it butts against the end flange of an axial sleeve and carries it forward against the pressure of a large coil spring. Between this sleeve and that upon which the piston slides is a third sleeve, this latter being also carried forward by ball abutments between it and the end-flanged sleeve. The balled sleeve is attached to an axial sliding tube extending the whole length of the inner-airscrew shaft back to, and through the centre of, the oil-distributor on the gear box rear cover. Thus, when the piston butts against the end-flanged sleeve, the third sleeve is also moved forward and, consequently, the sliding tube travels forward too. The movement of the tube is used to alter, by means of a mechanical linkage, the position of the piston-valve in the constant-speed unit of the airscrew controller, and so direct oil to the front (coarse-pitch) side of the airscrew piston to prevent further movement of the blades to finer pitch.

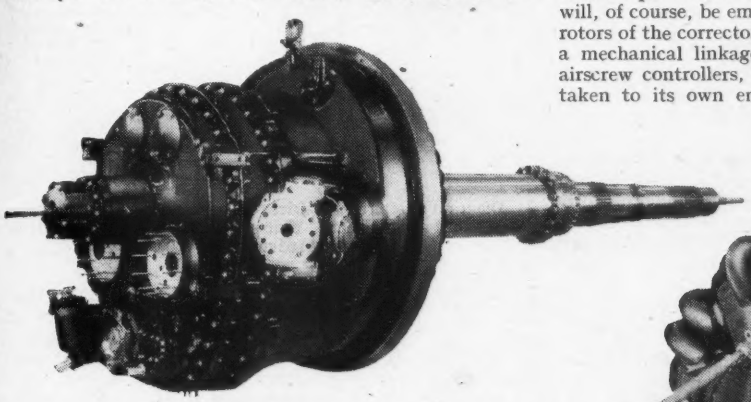


This illustration of the full-size test rig installation shows the arrangement of the engines in the wing leading-edge forward of the front spar. A considerable number of hours' running has been done.

DUPLEX AIRSCREWS

For the rear airscrew the same end is achieved by having an annular plate at the rear of the hub, actuated through spring-loaded plungers moved by strikers on the blade roots. As the blades turn to finer pitch the strikers depress the plungers and the annular plate is moved rearward. An Oilite rubbing pad bears on the plate, and a linkage from this is taken to the c.s.u. in the controller unit.

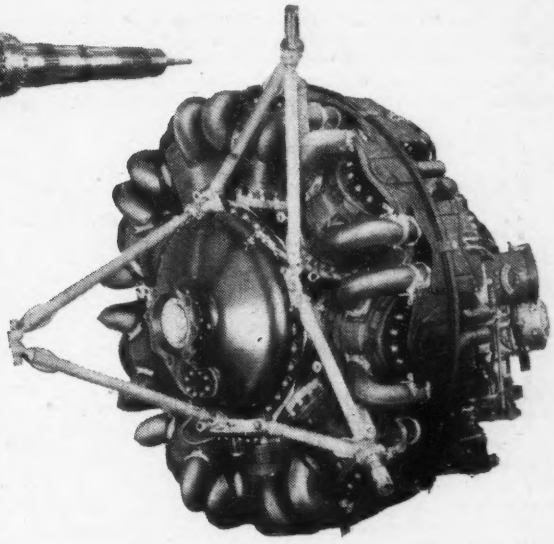
When airscrew braking action is required, the balls in the front-cylinder sleeve are allowed to escape into recesses, and so permit the unrestricted forward movement of the piston without concurrent movement of the sliding tube. Similarly, on the rear airscrew the arrangement of spring loadings on the plungers permits the fine-pitch stopping to be appropriately overridden, and so allows the requisite negative-thrust pitch-change movement of the blades.



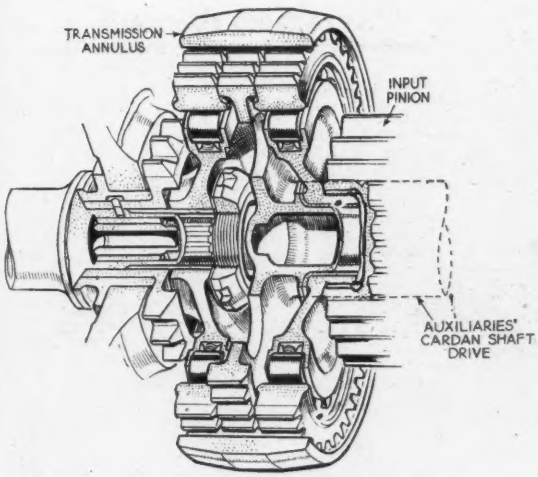
Three-quarter rear view of a gear box, showing airscrew shafts, input drive universal joint, and mounting faces on rear cover for synchronizers, airscrew controllers, auxiliary carden shaft drive, etc.

Engine/airscrew control in this power installation is unique, and on this count alone is thus worthy of study, quite apart from any intrinsic merit of design *per se*. The system embraces synchronous control of the engines as a complement and an addition to the control of airscrew pitch for constant-speeding, feathering and braking functions. In view of this we might thus review the synchronization part of the system first.

On the rear cover of each gear box are mounted two synchronizer alternators and two corrector motors (one each for each engine)—the alternators and corrector motors for all engines being inter-wired. The system is based on the selection of one engine as a "master," the remaining engines being subject to automatic continuous correction to the governing r.p.m. of the master. (The left-hand engines of each pair are arranged as masters—only one of which will, of course, be employed as such at any one time.) The rotors of the corrector motors are joined by worm gears and a mechanical linkage to the constant-speed units of the airscrew controllers, and one winding of each corrector is taken to its own engine's alternator, the other winding being connected to the alternator of the master engine. Each corrector is, in fact, an electric differential which, when all engines are in phase, will not turn. But when a speed difference does exist, it will rotate at a speed proportional to the difference, and in a direction determined by whether its engine is overspeeding or underspeeding relative to the master.



Three-quarter front view of a right-hand engine, showing the unique double-tripod-and-vee mounting structure, and input half of transmission shaft coupling. Note the doors in the cylinder head sealing shrouds for access to the sparking plugs.



Detail of free-wheel device illustrating wedging-roller and drive members. A drive diagram is shown on page 698.

Airscrew Controlling

The correctors are interposed in the linkage between cockpit and c.s. units, and in operation the system is very simple. When all engines have been started, the requisite r.p.m. are roughly selected, the master engine selected, and the synchronizer then switched on. At once, all seven Centaurus will be synchronized with the r.p.m. of the eighth, master, engine; this action will continue providing no one speed control lever is moved relative to the others more than an amount equivalent to a difference of 250 r.p.m. Should the selected master fail for any reason, one of the remaining three possible masters can be substituted by switching over, the faulty engine being stopped and feathered: all seven remaining engines will continue to run synchronously.

Since the Brabazon I airscrews have to do more than merely constant-speed, the conventional constant-speed

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governor unit is not sufficient for overall control. Thus units which are termed "airscrew controllers" are used, and these incorporate the normal c.s. units in addition to other elements. As is well known, the constant-speed unit is a valving medium for the direction of actuating oil (supplied by a pump) to one side or the other of the airscrew piston to effect blade pitch-change. The valve is governed by the action of centrifugal bob-weights to uncover the appropriate valving ports as engine speed needs to be increased or decreased by fining-off or coarsening the blade pitch.

Airscrew Braking

However, for the braking action the c.s.u. must be isolated, or rendered ineffective, since in the negative-pitch range constant-speeding is not required, the airscrew being, in effect, a fixed-pitch type for this duty. To permit this, a change-over valve is embodied in the airscrew controller, this valve being actuated by solenoid-operated valves, themselves operated by the action of taking the engine throttle levers back through a gate for reverse-thrust braking. A special high-delivery "reverse" pump, incorporated with the c.s.u. pump, normally passes its output through the change-over valve in an idling circuit; but when the "braking" solenoid is energized the change-over valve is moved and the reverse-pump delivery is directed to the fine-pitch side of the airscrew piston, the high output resulting in the very rapid pitch change rate of about 50 deg/sec. Normal oilflow between c.s.u. and airscrew is taken through the change-over valve, and when this is actuated for braking, it closes the ports connecting to the c.s.u., so rendering it ineffective. The c.s.u. pump output is concurrently fed back through a relief valve to the suction side of the pump.

Feathering is conventionally carried out by means of manual selection of the requisite c.s.u. valve position, and energization of the separate high-output feathering pump.

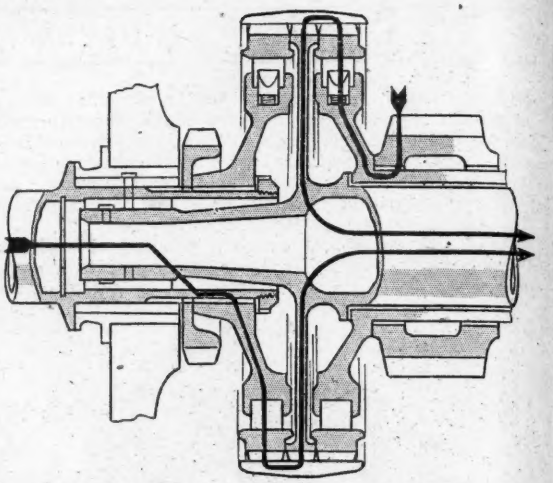
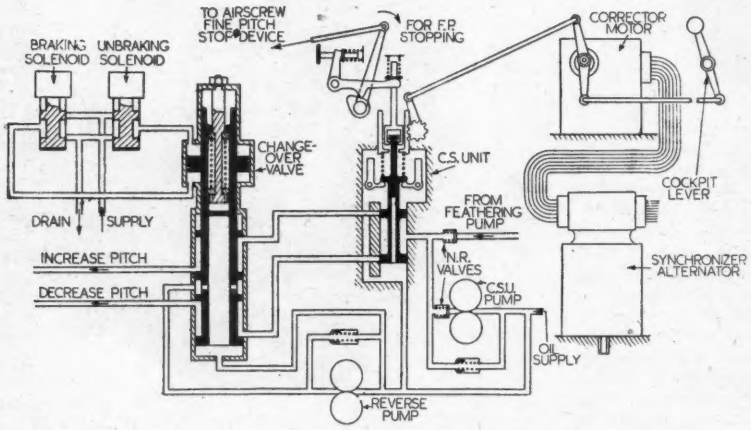


Diagram of alternative drives through wedging-rollers, transmission annulus and central wheel to cardan shaft for auxiliaries drive.



Schematic layout of control system for *one airscrew*. The flow of control oil may be followed together with synchronizer and fine-pitch stop actuation.

AERO GOLFING SOCIETY

ON Tuesday last week *Flight* had the pleasure and honour of entertaining members of the Aero Golfing Society to dinner at the Royal Aero Club, 119, Piccadilly, W.1. Trophies were presented for last year's competitions, and the occasion served also as a meeting for the election of new officers.

Several informal and characteristically humorous speeches were made, notably by Lord Brabazon of Tara, who presided, Sir Frederick Handley Page, retiring captain, and the new captain (proposed by Mr. Robert Blackburn) Major A. Michell Clarke. Mr. Claude Wallis and Mr. Geoffrey Smith welcomed the guests.

Prizes presented included the Instone trophy to Mr. D. P. Cameron (83 less 4=79), the *Flight* trophy to Group Capt. P. W. S. Bulman (100 less 18=82), Colonel W. A. Bristow's Jubilee trophy to Mr. H. G. Bentley (75, Stableford, two rounds), and the Cellon trophy also to Mr. H. G. Bentley (64 plus 2=66). The Captain's prize went to Mr. A. E. L. Skinner, who returned the best aggregate for the year.

Sir Frederick Handley Page proposed a vote of thanks and presented a handsome watch to Commander Harold Perrin, the society's indefatigable secretary.

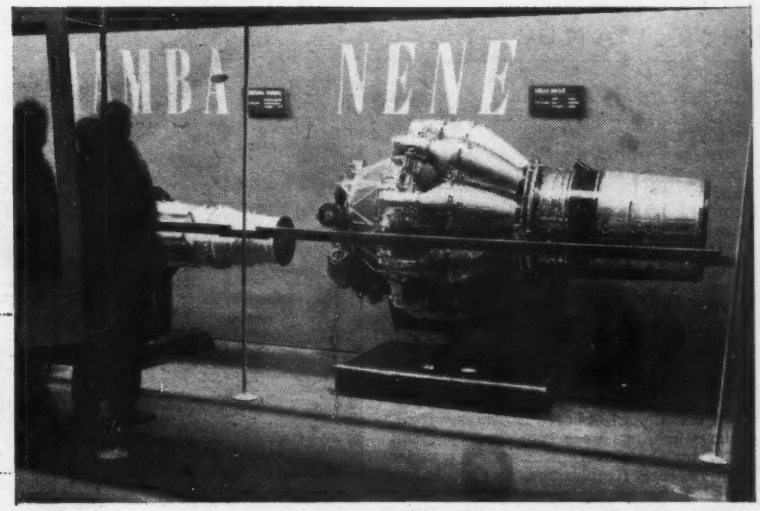
In addition to the President (Lord Brabazon) and the Captain, officers for the year 1947 were elected as follows: Vice-Captain, C. S. T. Thom; Committee: P. W. S. Bulman, J. R. Bryans, H G Bentley, D. P. Cameron, L. G. Callingham, C. F. H. Gough, Major R. H. Mayo, A. E. L. Skinner; Secretary, Commander Harold E. Perrin.

AVIATION CENTRE

Further contributions to the Londonderry House and Aviation Activities Fund.

Fairey Aviation Co., Ltd.	1,000	0 0
The Bristol Aeroplane Co., Ltd.	1,000	0 0
Rolls-Royce, Ltd.	1,000	0 0
The De Havilland Aircraft Co., Ltd.	1,000	0 0
Vickers-Armstrongs, Ltd. (& Associated Cos.)	1,000	0 0
Short Brothers (Rochester & Bedford), Ltd	525	0 0
Dunlop Rubber Co., Ltd.	500	0 0
Imperial Chemical Industries, Ltd.	500	0 0
Titanine, Ltd.	265	5 0
Alvis, Ltd.	262	10 0
Shell-Mex & B.P., Ltd.	262	10 0
Intava, Ltd.	262	10 0
Tube Investments, Ltd.	250	0 0
J. Stone & Co., Ltd.	250	0 0
Southern Forge, Ltd.	250	0 0
Sir W. G. Armstrong Whitworth Aircraft, Ltd.	250	0 0
Blackburn Aircraft, Ltd.	250	0 0
James Booth & Co., Ltd.	250	0 0
Armstrong Siddeley Motors, Ltd.	250	0 0
Birmid Industries, Ltd.	250	0 0
Airwork, Ltd.	250	0 0
Almin, Ltd.	250	0 0
Percival Aircraft, Ltd.	250	0 0
A. V. Roe & Co., Ltd.	250	0 0
Irving Air Chute of Great Britain, Ltd.	250	0 0
Miles Aircraft, Ltd.	250	0 0
Northern Aluminium Co., Ltd.	250	0 0
British Aviation Insurance Co., Ltd.	250	0 0

HERE AND THERE



TUBES AND TURBINES. The Nene and the efflux end of the Mamba glimpsed through a momentary gap in the visitors to Britain's first "jet show" recently opened at Charing Cross underground by Mr. Arthur Woodburn.

Wet and Windy

JUST before returning to this country from his recent tour of R.A.F. stations in Germany (mentioned on p. 711) Mr. Geoffrey de Freitas, Under-Secretary of State for Air, is reported by the Press Association to have telephoned his secretary in London and said:—

"It's raining here; I shall not fly back," and he arranged to travel by a B.A.O.R. leave train.

Cross-Channel Record

CONGRATULATIONS to ex-Fleet Air Arm James Bridge, the Gloster test pilot, who last week flew a Meteor IV from Le Bourget to Croydon in the record time of 23 min 37 sec, which was a handsome advance on the previous fastest of 41 min achieved by Sqn. Ldr. Cotes-Preedy just before the Paris Aero Show.

Readers will remember Mr. Bridge's very interesting article on "Deck Landing" in *Flight*, November 7th, in which he gave a deal of information on this specialized operation from his own experience on active service afloat.

Promotion

NO air correspondent needs any introduction to Mr. E. L. Baddeley, whose appointment as Assistant Chief Information Officer of the Ministry of Supply has just been announced.

As Press Officer of M.A.P. throughout its existence, his helpful affability, even under the most trying of wartime restrictions, made the work of war correspondents and pressmen in general much less difficult than it might otherwise have been, while the extent of his knowledge in matters concerning Service aviation verged on the encyclopædic.

Fleet Street and beyond will cheerfully drink his health.

Private View

THREE excellent little films were shown privately in the British Council Theatre in Hanover Street, London, W.1, last week, the audience being the guests of the S.B.A.C.

First came "Tomorrow by Air!" produced by This Modern Age Film Unit for the Rank organization, which was an historical review of the progress of aviation from the days of the earliest Farmans, Bleriots and similar "sticks and string" efforts to the present day Tudors, Vikings and Hermes, and a final glimpse of tomorrow in some excellent flying shots of the Nene Lancastrian, and of the Bristol 167 under construction.

Then came a Shell film, "A Single Point Fuel Injector," which was an admirable lesson in technicalities without tears, and finally the Air Ministry film, "Ship Busters," which comprised mainly operational camera records of Mosquitoes and Beaufighters doing their stuff with rockets against enemy shipping in the Norwegian fjords—thrilling and authentic.

AMERICAN AUSTER—ITY. Designed for similar functions to those of the British Auster, this somewhat angular consolidated Vultee L-13 has a 245 h.p. Franklin engine and a reputed take-off and landing run of only about 76 yd. Its span is 40ft 5½in and a.u.w. 2,900lb. It cruises at 92 m.p.h. with 300 miles range.

Dominion Pathfinders

A CANADIAN branch of the Pathfinder Association has now been formed and already has 150 members. But Alex Thorne, the tireless secretary at the parent club's Mount Street headquarters in London, tells us there is room for the many more Dominion eligibles, and that Bill Buck, the secretary of the new branch, will be delighted to hear from them at 79, Cowan Avenue, Toronto, 3, Ontario.

Mr. Buck—or to give him the fuller title of ex-Flt. Lt. W. Buck, D.F.C.—served during the war with No. 35 Squadron, R.A.F., which further distinguished itself last summer by its goodwill tour of America. Bill, however, had the tantalizing experience of being too far away from the nearest point on the squadron's itinerary to be able to see them. But he received all the "gen" later from Wing Cdr. Daniels, a former C.O. of No. 35, who was in the U.S. and was able to look up the Lancaster lads in person.

What a party that must have been!

Bang On!

WHEN, in *Flight*, August 29th, we announced the appearance of the Pathfinder Association's quarterly *Newsletter*, we suggested on a playful spur of the moment that this worthy organization's journal might have been called *The Marker*; the title seemed apt, pithy, and, above all, distinctive.

And now there has duly appeared the second (Christmas) edition of this lively little newspaper with its title changed

HERE AND THERE

to *The Marker* and with a paragraph giving due credit to *Flight* for the "excellent idea."

As goodwill is the "drill" just now, perhaps we may be forgiven for the above mild line-shoot inspired, of course, by a feeling of smug gratification.

Incidentally, this is the second "on target" suggestion which this column has supplied comparatively recently.

With suitable encouragement over Christmas, the hat-trick may be achieved at any moment!

Short Shares

COMPENSATION to former shareholders of Short Brothers, Ltd., whose holdings were compulsorily taken over by the Government in 1943 under the Defence Regulations, last week was fixed at 29s 3d per share by Mr. Justice Morris in the High Court. The shareholders had asked for 41s 9d per share, based on a valuation of the whole undertaking.

In giving reserved judgment for the Treasury, with costs, Mr. Justice Morris intimated that when the order was made expropriating the shares, what each owner lost was the value of the shareholding on the basis of the Stock Exchange prices ruling on the date of transfer, and not of some aliquot part of the company's property, as contended by the shareholders.

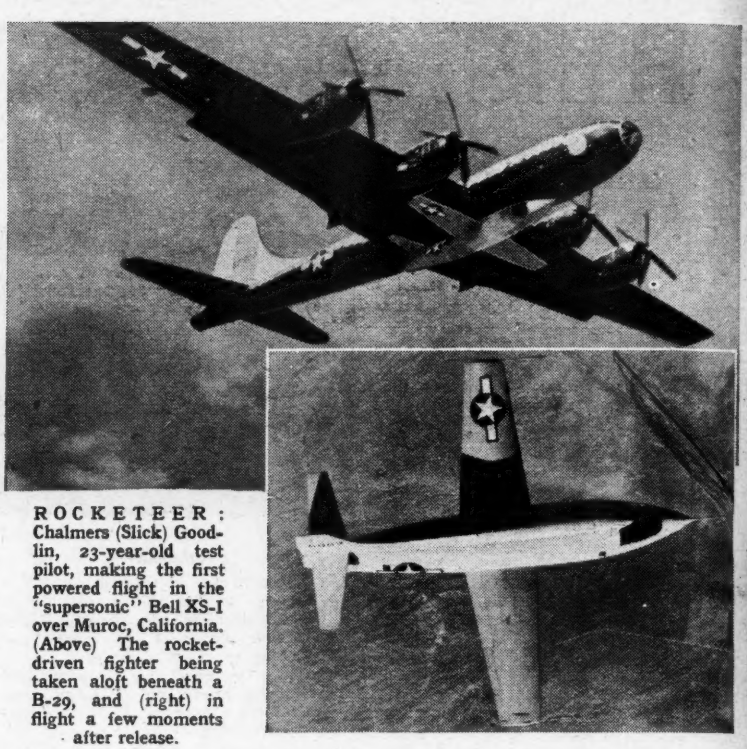
Model Research

THE extent to which technical development has advanced in the field of model aeronautics could hardly have been better demonstrated than by the scale jet-propelled Vampire at the National Model Aircraft Exhibition at Dorland Hall in Lower Regent Street, and the research people at Eaton Bray deserve full marks for a really notable achievement.

Incidentally, that word "aeromodeller" caused a conversational misunderstanding which led to the Association of British Aeromodellers (A.B.A.) being given credit for the Vampire model in *Flight's* report on the show last week, when it should have gone to *The Aeromodeller*, which runs the Eaton Bray research department. Our apologies to both.

The aeromodelling wizards are, of course, also responsible for the catapulted float-plane and its submersible launching gear, which earns a "hand" from the spectators at each successful demonstration.

By the way, has anyone worked out the scale-model "g" at the moment of release?



ROCKETEER: Chalmers (Slick) Goodlin, 23-year-old test pilot, making the first powered flight in the "supersonic" Bell XS-I over Muroc, California. (Above) The rocket-driven fighter being taken aloft beneath a B-29, and (right) in flight a few moments after release.

News in Brief

MASSES of Dutch flowers are now being flown to England by K.L.M. on their freight service to London.

* * *

Eight Vikings have been ordered by South African Airways who are also buying three more Skymasters to add to their present fleet of three of these four-engined American airliners.

* * *

Mr. H. B. Moss, the Dunlop district manager in Buenos Aires before the war, is returning to the Argentine as sales manager of the Dunlop Pneumatic Tyre Co. (S.A.), Ltd. He was recently demobilized from the R.E.M.E.

* * *

When a 90 m.p.h. gale—the worst ever recorded in Brisbane—swept the Archerfield airport there, five Douglas airliners, valued at £100,000, were piled together and badly damaged. The aircraft were parked outside the Qantas hangers, and the airline was negotiating for their purchase.

* * *

The success of an experimental consignment of Spanish tangerines which were flown to London resulted in the decision to fly a further 375 tons of the fruit to this country by Halifax freight aircraft from Barcelona. As the tangerines have to be transported 200 miles to the airport by road, the Valencia fruit-growers are pressing for their local airfield to be enlarged to make it available for heavy aircraft.

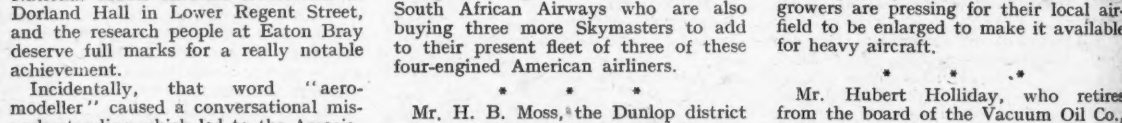
* * *

Mr. Hubert Holliday, who retires from the board of the Vacuum Oil Co., Ltd., on January 1st, started with the company as an office boy on January 22nd, 1901, and has been managing director since 1933. For many years he has taken a keen interest in motoring sports, and was a familiar figure at race meetings and track events.

* * *

A new factory for the production of high-speed diesel engines is being erected by F. Perkins, Ltd., at Newark, near Peterborough, on a 70-acre site which will include a sports ground as well as the works and administrative offices. Operated on an eight-hour shift basis during a five-day week, the factory is expected to have an output of one engine every 20 minutes.

AIRSTRIP . . . . No. 45



BIRDS *CAN* FLY

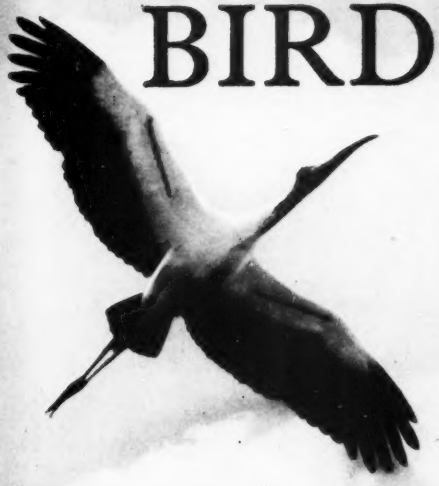
Perfect View and Control: No Engine Failures: Vertical Landings

By J. Laurence Pritchard

AS an aid towards reducing accidents in the R.A.F., the Air Ministry decided, during the war, to issue a set of posters showing different aspects of bird flight. In the preparation of these posters, which are now being re-issued, the Air Ministry was helped by Graham and Gillies, Ltd., who went to a great deal of trouble to collect the bird photographs.

The wording on each poster was based upon the assumption that over-confidence is the cause of a large proportion of accidents. No pilot would deny that the birds have many more flying hours, and yet their accident rate is probably nil.

Capt. Pritchard, secretary of the Royal Aeronautical Society, has made a close study of bird flight, and we are glad to publish his comments on the posters. Note particularly his concluding remarks: "Study the posters and start talking!"



12,000 CONTROLS

Twelve thousand controls in the form of muscles are operated by the Ibis in working its feathers alone. That's a few more than you've got to worry about. The Ibis has to rely on instinct not reason—but he never pulls the wrong lever. The Ibis is a good pilot.

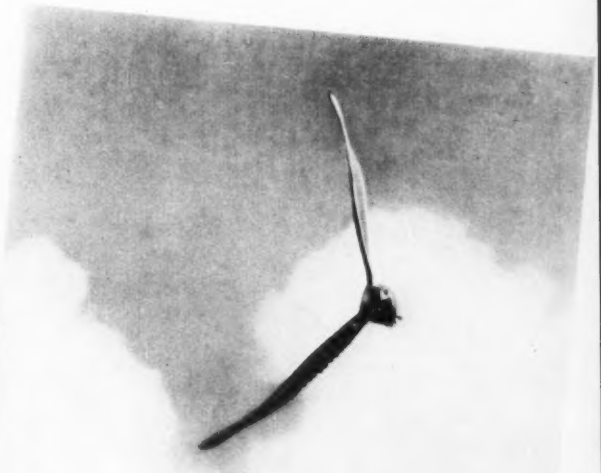
"THERE be three things which are too wonderful for me, yea, four which I know not," said Solomon.

The first was the way of an eagle in the air, and the fourth the way of a man with a maid. Of both ways the pilot of an aircraft should obtain as much knowledge as he can, for one will give him a sense of security in the air and the other a sense of stability on the ground.

The Powers-that-Be in the Royal Air Force appear more concerned with the way of an eagle in the air than the way of a pilot with a maid. At any rate they have issued a most excellent series of Safety Posters of birds (feathered) which are at once a delight to the eye and of profit to the discerning mind.

There is so much which both pilots and aircraft designers can learn from the bird. Look at the frigate bird, flying low; the eagle; the gannet and the stork landing; or the swan taking-off. Note in all cases the perfect view which the pilot has. It is the kind of view the modern aircraft pilot should demand and the aircraft designer should provide.

Note another thing, too: the control which these, and in fact all birds, have at the moment of landing or taking-off. Birds' engines don't conk when they are taking-off; their undercarriages don't refuse to go down on landing, nor do birds find their controls soggy at low speeds. All these three things are yet to be thoroughly mastered by the aircraft designer.



Steep Turn

No skid or slip—dead accurate. But look at the direction of his head. He remembers to look round to see if all is clear.

BIRDS CAN FLY

RAMSHACKLE CONSTRUCTION?

So it seems. (But he never forgets to lower his undercarriage when he comes to land.) The Stork goes on flying until he is 70, because he is master of his equipment, and doesn't take chances.

I feel that pilots should take a much more active interest in the technics of their machines, both from an aerodynamical and structural point of view, and should not accept them as they are and learn to fly something which had no right to be in the air at all.

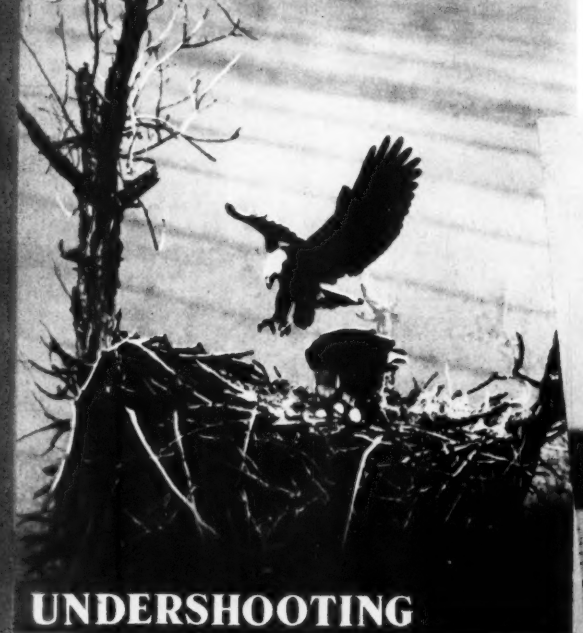
I am well aware that birds have lower wing-loadings, lower Reynolds numbers, lower speeds, lower ceilings, lower ranges and, in fact, are low kinds of things altogether from the designer's point of view. But from the pilot's point of view they have higher margins of safety, better forms of control, better views, and a better knowledge of when and where to fly.

Landing Requirements

When either an aircraft or a bird lands, the three things wanted at that particular moment are: the maximum amount of lift in the circumstances in order to keep the sinking speed as low as possible; the maximum amount of drag in order to keep the forward speed as low as possible; and the maximum amount of control to keep the margin of safety as high as possible.

Look at the gannet landing. This is by no means an abnormal landing attitude of many birds. It is not a lucky snapshot of one peculiar landing. I have photographs of the eagle, the condor, the stork and other birds landing in exactly the same way. And they don't put their flat feet on their children, or mother would have much to say about it.

Now one doesn't expect the fuselage of an aircraft to be vertical at the moment of landing, but landing



UNDERSHOOTING

For ten million years the eagle family has been flying. Yet the eagle cannot take flying liberties. Young eagles fall if they do.

On the short side during the run-in, this eagle puts on power and completes his landing with a few beats of his wings. He made up his mind early.

SWANS' TAKE-OFF

This pair of swans is 50 years old. They've been flying ever since before the first aeroplane. Yet there is no risk in their take-off. Every time they choose the longest run into wind, with no obstacles in front.

at speeds of the order of 100 m.p.h., with the knowledge that the controls are not quite so effective as they are at 200 m.p.h., does call for considering more and more the problem of lower landing speeds and better controls. It should not be beyond the skill of designers to alter wing shapes to the necessary extent, by making more use of moving surfaces which are automatic when the speed drops below a certain level.

Here are a few facts about bird flight which are worth thinking about. R.A.F. pilots have reported sandpipers at 12,000 feet, rooks at 11,000 feet and many others at 6,000 to 8,000 feet. The condor has been observed at 20,000 feet and geese at 29,000 feet.

As regards the speeds of birds, they have been greatly exaggerated in the past. Twenty-five to fifty miles an hour is a general average. For short bursts considerably higher speeds have been recorded. A flock of American golden plover has been timed over the measured mile at 70 m.p.h., and the swift at over 100 m.p.h. There is one measurement on record by Stuart Baker, over a two-mile course, of swifts reaching 200 m.p.h., but this figure should be treated with some reserve.

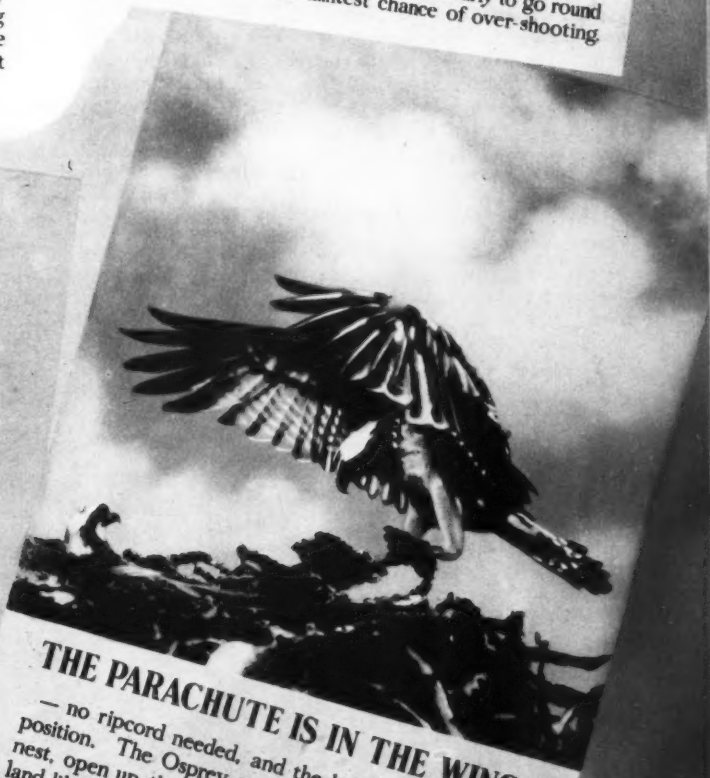
Take-off Technique

Birds always get off facing the wind and how certain they are that this is the correct way may be noticed by watching sparrows rising from the road in front of a car. If they are towards the lee side of the car, they take the lesser risk of flying in front of it before turning away, for they know they will make a quicker and more controllable get-away. Long-winged birds with short

OVERSHOOTING?

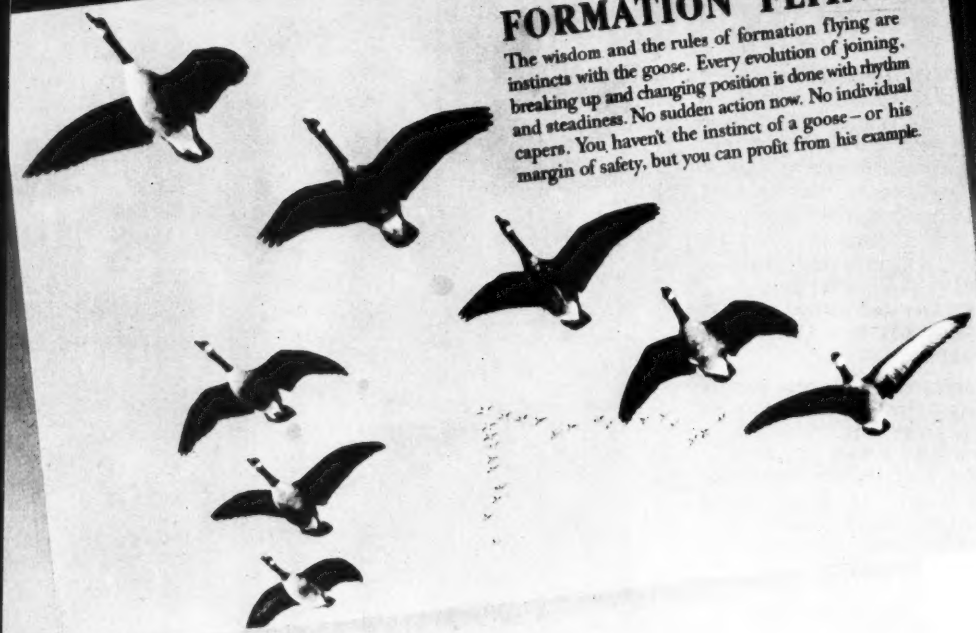
Not the gannet. If he comes in too fast or misjudges his glide he can pull up and still get in. A pilot is not so well-equipped and must make up his mind early to go round again when there is the faintest chance of over-shooting.

OW FLYING The Frigate bird has a body size of a chicken — but a wing span of 7 feet. These gs can easily get caught in bushes and trees. When that pens, he's had it. For this reason the Frigate bird never low except when on operations — in search of food.



THE PARACHUTE IS IN THE WINGS

— no ripcord needed, and the harness is always in position. The Osprey can come in inches from the nest, open up this million-year-old safety device, and land like a feather. Remember pilots are not so well-equipped, and must fly accordingly.



FORMATION FLYING

The wisdom and the rules of formation flying are instincts with the goose. Every evolution of joining, breaking up and changing position is done with rhythm and steadiness. No sudden action now. No individual capers. You haven't the instinct of a goose – or his margin of safety, but you can profit from his example.

undercarriages often cannot get off at all in the absence of wind.

Great use is made by birds of their tails for control, for changing direction and for increasing speed and so height. Their tails are adjustable in both the horizontal and vertical directions, and are used in automatic conjunction with movements of the head and, in the case of web-footed birds, with their feet, which are often used as rudders.

Long-range Migration

In a general way the bird makes most use of wing-tip and tail control where, in fact, controls have the greatest effect with the least effort.

The flying ranges of birds vary widely. Most of the migrating birds fly several hundred miles before resting. The most startling example, however, is the golden plover which migrates from Alaska to Hawaii, 2,500-3,000 miles across water, without landing.

If a pilot, after seeing the safety photographs, is still inclined to believe he has nothing to learn from the bird, I recommend him to watch a mallard duck making a vertical ascent from the water; the swan taking-off with the certainty of a clear run ahead; and the condor landing on the branch of a tree, with no fear of overbalancing.

Fine controls make fine pilots, just as much as fine feathers make fine birds. So study these posters and start talking!

TAKE-OFF WITH FISH The additional weight means a longer run to get airborne. As the duck doesn't want to lose his dinner, he takes plenty of room and gains full flying speed before climbing.

CIVIL AVIATION NEWS

British Civil Aviation Council : Irish Services Resumed

SEASONABLE—but not in this country, or even during this winter. A scene at La Guardia airfield, New York, a year ago. A snowfall of this calibre is not very likely at Heathrow, but is a possibility against which plans must be made.

ATLANTIC DILEMMA

IMPERIAL AIRWAYS were at work in Newfoundland in 1934 making upper-air surveys and obtaining meteorological information. The Gander Lake area was eventually chosen for the airfield for the transatlantic experiments, and in 1936 clearing operations started over an area of 778 acres of young trees. The original plan was to include three runways, 1,500 yards long and 200 yards wide, and one 1,600 yards long and 400 yards wide.

That is how Gander Airport began. Its importance would undoubtedly have increased automatically as more international airlines flew scheduled services across the North Atlantic but it would not have grown so rapidly without the impetus of war.

The Atlantic had never been flown during the winter when yet another small party of B.O.A.C. officials went to Newfoundland in 1940 to establish an organization for the delivery by air of American aircraft to this country, and a return ferry service to take from the United Kingdom to Newfoundland the aircrews needed to fly them. The importance of Gander to the war effort became vital, and commensurate improvements were made to the airfield, the services and buildings, and three of the runways were extended to 2,000 yds. By the end of the war Canada had spent about £6,250,000, Great Britain some £833,000, the R.A.F. about £750,000 and Newfoundland £165,000 on Gander.

Control Transferred

Early in 1946 the Governments of Canada, Newfoundland and the United Kingdom examined various problems relating to the defence installations which had been constructed in Newfoundland, and reached the agreement that Canada should re-transfer control and operation of Gander to the Government of Newfoundland, together with all buildings, hangars and works constructed by Canada. All equipment and stocks, with certain exceptions, were included for a total payment of a quarter of a million pounds.

On the face of it Newfoundland would appear to have made a good bargain, but now that the airfield no longer has a militarily strategic position, and is a mere stepping-stone between Europe and the United States, it is a doubtful asset. All airlines at present flying schedules on the North Atlantic route land at Gander to refuel. This must also apply to the infrequent transatlantic charter aircraft. Unless there is unforeseen delay, passengers have no occasion, or even opportunity, to spend more than a minimum amount of time in Newfoundland, and, consequently, the country does not benefit financially.

The source of income at Gander is limited to landing fees and servicing charges and, even with landing fees twice those charged at La Guardia, the airport is costing Newfoundland anything up to a quarter of a million pounds a year. These figures have been revealed by Mr. J. S. Neill, member of the appointed commission now governing the country, and who rightly considers it unthinkable that Newfoundland should be expected to run Gander Airport at its own expense for the benefit of international aviation in which it has no direct interest. These sentiments have been communicated to the British Government, and it is understood that a delegation from the Ministry of Civil Aviation is to go to Newfoundland to examine the future prospects of Gander.

Provision is made within the organization of P.I.C.A.O. for assistance, financially or in kind, to be given to those states unable to supply, on their own, those facilities required for international air transport. As the British Government is so closely connected with the welfare of Newfoundland, there may be some reluctance to appeal to P.I.C.A.O. for support. On the other hand, it would be an imposition upon the British taxpayer if he was asked to bear yet another burden for outside interests.

Even as an important airport, the future of Gander is uncertain, for it cannot be far distant when transatlantic aircraft will fly direct to and from New York and the other American terminals. Air traffic might then easily dwindle to private owners and some short-haul schedules from Canada and the United States for those who wish to enjoy the good fishing and hunting in Newfoundland.

Even the future of Newfoundland itself is uncertain and until the international status of the country is decided there is unlikely to be any settlement of the Gander problem.

NATIONAL CONSULTATIVE COUNCIL

THE Parliamentary Secretary to the Ministry of Civil Aviation has announced the terms of reference for the recently formed National Civil Aviation Consultative Council, and has published a list of the trade, professional and technical organizations represented on it. The Council is to review the developments in civil aviation generally, and assist the Minister in the examination of questions relating thereto.

The Minister has invited the following to be represented on the Council. For the operators, the Association of British Aero Clubs, British Air Charter Association, British Gliding Association, the Royal Aero Club and the three British Airways Corporations. Representing personnel, in addition to B.A.L.P.A., are the Radio Officers' Union, the T.U.C., and one representative for the other unions. The S.B.A.C. and the Radio Industry Council represent the constructors. For the users, the Association of Municipal Corporations and one representative from either the Institute of Travel Agents or the Creative Tourist Agents' Conference, and one from the Joint Air Transport Committee of the British Chambers of Commerce, the Federation of British Industries, and London Chamber of Commerce. In a general group the main insurance companies

CIVIL AVIATION NEWS

and Lloyds are invited and also the Aerodrome Owners' Association, G.A.P.A.N., the Institute of Transport, the Society of Licensed Aircraft Engineers, the Advisory Councils for Scotland and Northern Ireland, and Sir G. Bruce representing Wales.

FREE ENTERPRISE IN INDIA

NEWS has come through from Bombay that the Government of India has decided not to run civil aviation as a state department. This means that there is no imminent prospect of nationalization in India, and the applications from seventeen new companies for permission to run internal air services will be heard. A special Air Transport Licensing Board has been created to examine such applications, and this Board will exercise strict control over the operation of civil airline companies in India—allotting routes, fixing rates and issuing certificates of airworthiness—presumably having similar powers to the C.A.B. and C.A.A. in America.

LET US BE CATAPULTED

AN American method of assisted take-off, using the device known as the Westinghouse Electropult, has now been re-designed for use with really large aircraft. With the new version it is estimated that types of Constellation size can be accelerated to a speed of 120 m.p.h. over a run of 500ft. The maximum acceleration would be about 1G, and this would be built up during the first two seconds. No example of this size has, however, yet been made.

The principle of the Electropult is one of inertia—the necessary energy being stored in a 24-ton flywheel which drives an A.C. generator to supply momentarily some 12,000 kW to a 1,382-foot-long induction motor. The aircraft is attached to a "shuttle" car by means of a steel cable and this car tows it down the motor track. The whole cycle is started by a Pratt and Whitney aircraft engine.

LESSON IN CO-OPERATION

PAN AMERICAN AIRWAYS have installed at Gander Airport a Ground Controlled Approach unit for experimental and training purposes, and as a supplementary approach aid. The unit has been leased from the American Army and will be operated by Army personnel. P.A.W.A. are putting all captains and first officers flying transatlantic aircraft through a special familiarization course on G.C.A. as part of their instrument flying refreshers. Apparently the training has been progressing since the beginning of October, using a Naval mobile unit at Floyd Bennett field. This unit is regularly used by the American Naval Air Transport System, but the equipment has been made available to Pan American and other United States airlines.

The use of this system at Gander will not presumably be restricted to pilots flying Pan American aircraft, so that when the unit at Heathrow is operational, pilots of all nationalities will have an efficient emergency blind-approach system on both sides of the Atlantic on which to depend. It is interesting to observe the degree of co-operation between the American Army and Navy and the civil operators. From the traffic control angle, Service and civil flying should operate as a unit.

COME-TO-BRITAIN CAMPAIGN

THE British Travel Association are making determined efforts to attract foreign visitors to this country. Lord Hacking, the chairman, considers that the only restriction to the number of tourists who will in future visit this country will be the carrying capacity of the airlines and shipping companies. In 1947, he estimates there will be sufficient accommodation and food for all those who can find means of transport, provided accommodation in this country is booked before arrival.

At a recent reception Lord Hacking made an appeal for courtesy. People of this country must appreciate, he said, that a good first impression to foreign visitors is essential, and we must learn to develop the valuable natural assets in Great Britain and present them courteously to our visitors. A "Come-to-Britain" poster competition for the youth of Great Britain has been started, and the winning poster will be reproduced and given wide circulation all over the world. A striking pictorial poster of London, in twelve colours, designed by Mr. Kerry Lee, will have a circulation of 25,000 copies. This is also designed to attract visitors to London.

British European Airways have offered as one of the prizes for the poster competition a return trip to Holland. The successful competitor will spend two days in Amsterdam as a guest of the Corporation.

SERVICES TO N. IRELAND

THE ex-R A.F. station at Nutts Corner has been opened by the Ministry of Civil Aviation for the use of all types of civil aircraft. The airfield has three runways, 2,000, 1,600 and 1,230 yards long, full night flying facilities, and Standard Beam Approach. Customs facilities, if necessary, can be arranged with Sydenham.

British European Airways have resumed scheduled services with Dakota aircraft between Nutts Corner and the two Scottish airports, Prestwick and Renfrew. Three services a day in each direction are being run, including one in the late evening from and to Prestwick. When Renfrew is fitted with night flying and S.B.A. equipment, a similar late service will be run to that airport. Until these aids are available it may be necessary in bad weather to divert that service to Prestwick. In that case, arrangements will be made for Glasgow passengers to complete their journey from Prestwick free of charge.

Road transport will be provided without additional charge from Glasgow to Renfrew, from Prestwick station to the airport, and from Belfast to Nutts Corner—which, incidentally, is north-west of the city and the journey takes about twenty minutes by road.

CIVIL LICENCES

IN the issue of December 12th we gave details of the new system for licensing civil pilots in Australia, and mentioned that it followed closely the plans for flying licences in this country.

The Personnel Licensing Division of P.I.C.A.O. is due to meet on January 7th to discuss the question of standardization of licensing for all aircrew categories and ground engineers, and it is upon decisions reached at that conference that revision of our own system will depend.

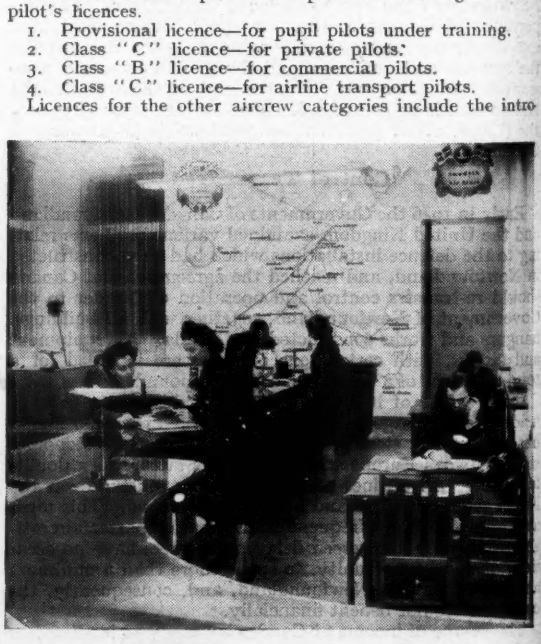
It is probable that the British delegates at the conference will advocate the system which was outlined in *Flight* of February 7th, and which we understood to have resulted from discussions at the Chicago Conference in 1944 and in London and Paris last year.

Probably the greatest changes are for pilots, in which the intention is to differentiate as clearly as possible between the qualifying standards required from private owners, commercial pilots and regular airline pilots.

Four classes are expected to replace the existing A and B pilot's licences.

1. Provisional licence—for pupil pilots under training.
2. Class "C" licence—for private pilots.
3. Class "B" licence—for commercial pilots.
4. Class "C" licence—for airline transport pilots.

Licences for the other aircrew categories include the intro-

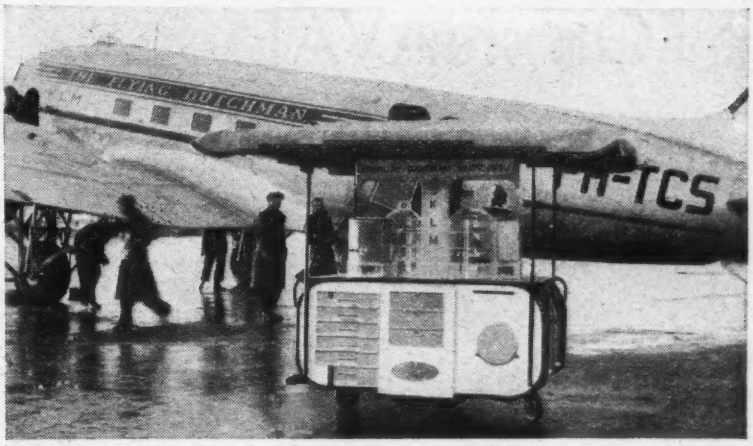


OVER THE COUNTER: A view of the business side of the ABA information centre in Regent Street which was opened on December 11th.

duction of "Cadet Class" licences, and for ground engineers a greater range of responsibility with the prerequisite of more extensive qualifications. Five radio operator categories were originally envisaged for both W/T and R/T.

HEALTHY COMPETITION

BEFORE the Australian Federal Parliament is the Bill which, if passed, will enable the Australian Government to purchase the half-share interest in Qantas Empire Airways which is at present held by B.O.A.C. This step has always been a possibility, but the B.O.A.C. plans, even if decided upon, have not yet been made known. When the Australians have control of Q.E.A. they will naturally fly the entire route between Australia and the United Kingdom with their recently ordered Constellations. B.O.A.C. will, in turn, also fly the entire route instead of running, as at present, a "half-way" arrangement, and must be content with Lancastrians or Yorks on the landplane route until they can be replaced by Tudor IIs or other aircraft.



ELEVENSES: Presented to K.L.M. by the Tea Propaganda Bureau, this electrically propelled refreshment trolley is used at Schiphol to cheer those working on aircraft or in hangars away from canteen facilities. Apart from any other considerat on this in en ous device should save many hundreds of snack-time-walking man-hours.

BREVITIES

IT is understood that Trans-World Airlines will start a direct air service next month from Washington, New York, through Palestine to India.

* * * *

The first Douglas aircraft to operate commercially in Australia, a DC-2 named *Bungana*, finally completed its service with Australian National Airways in September after flying 33,000 hours. The instrument panel has been presented to the National Museum.

* * * *

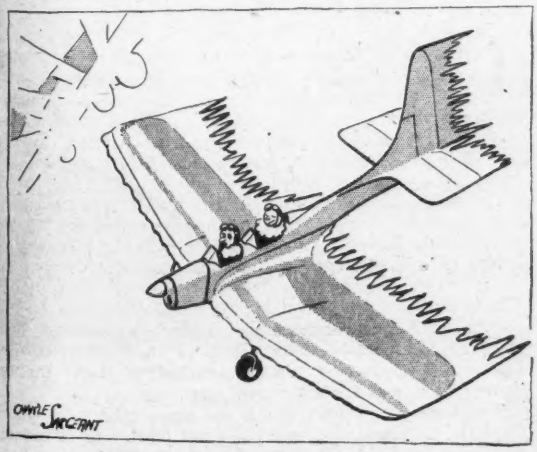
Ansett Airways, a subsidiary of Ansett Transport Industries, is organizing a combined air-coach tourist organization throughout Victoria and Tasmania. A daily service by air from Melbourne is now operating with Dakota aircraft, on which eleven seats are reserved for the combined air-coach tours. This is a new departure for airline operation in Australia.

* * *

Capt. Dudley Travers will be "on the air" on Christmas Day. The broadcast will be made from the *Golden Hind* homeward bound from Cairo, a few minutes before the King's speech.

* * *

The Canadian Airline Pilots' Association has elected Capt. Charles R. Robinson to be their new president, and Capt. J. A. Wright to be the vice-president for the Eastern Region. At the conclusion of the first post-war convention held recently in Montreal, the Association declared that it would strive for improved operating standards and pay for aircrew, and bring other airlines nearer to the standard of T.C.A.



"Seasonable weather, don't you think?"

Mr. Gerard d'Erlanger, the managing director of British European Airways, has been elected a member of the Air Registration Board.

* * *

A party of Venezuelan officials is due to arrive at Stockholm in the near future to discuss the possibility of an air service between that country and Sweden.

* * *

D.D.L. have converted a Flying Fortress to carry passengers. The aircraft is at present on a charter flight between Copenhagen and Nairobi, carrying fourteen passengers.

* * *

Trans-World Airlines have announced extensions of their trans Atlantic service, from Paris to Geneva, Rome and Athens.

* * *

Mr. T. Munro, who has been with Imperial Airways and B.O.A.C. since 1932, has been appointed B.O.A.C. station superintendent at Lagos, West Africa.

* * *

It has been announced that H.R.H. Princess Elizabeth has consented to name the first Tudor I aircraft for B.O.A.C. The ceremony will take place at London Airport on January 21st, when the aircraft will be named *Elizabeth of England*.

* * *

As part of the performance tests of the Tudor I, B.O.A.C. started on a proving flight this week to Cairo and Nairobi. It is hoped to gain information on the performance of the Tudor I before proceeding with actual trials on the North Atlantic route.

* * *

Mr. C. W. Evans has retired from Hunting Air Travel and will join Morton Air Services on January 1st as publicity manager. Mr. Evans has been connected with publicity in several of the British charter companies during the past twenty years.

* * *

A recent order for three D.18.S Beechcraft twins by Ambica Airlines of Bombay, and of a fourth of the type by Tatas, remind one of the fact that during the war No. 742 Squadron of the Royal Navy completed a million miles of transport work in India without casualty. Most of this Squadron's aircraft were C.45s, or Expeditors. The pilots of the Squadron were all, or nearly all, with non-operational medical categories and provided one more example of the good work done by the ancient and infirm.

* * *

Early in 1947 the Danish Government Air Department intend to issue a new series of *Notices to Airmen* in Danish and English, giving detailed information concerning airfields available for civil flying in all parts of Denmark. It is understood that it will be impossible to supply individual demands, but copies will be sent to airline companies using Kastrup and the main Danish airfields, and also to the main aviation information bureaux in Britain, from which information may be obtained.

FOR NAVAL NEEDS

Latest Firefly IVs on Test at Heston

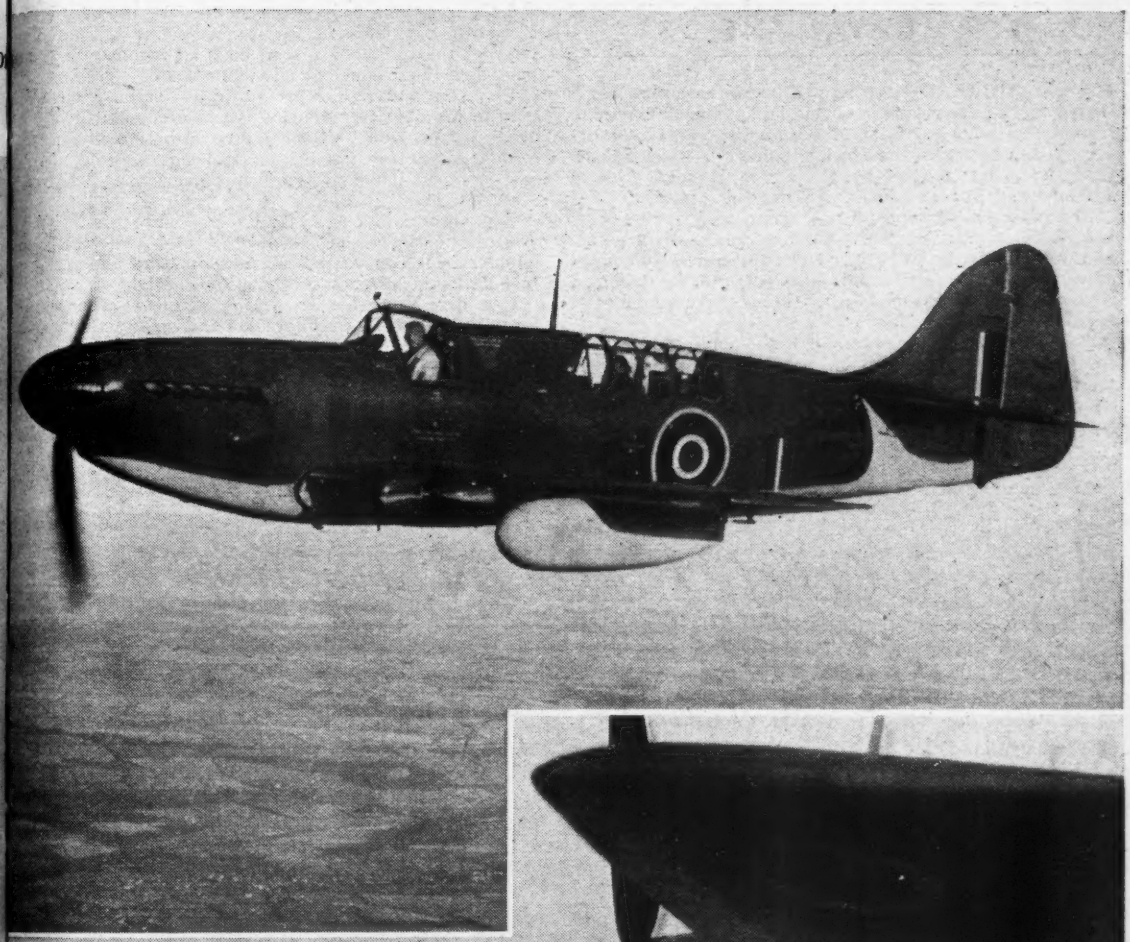
Completely painted and with wing nacelles installed—a Firefly IV on its final test. On the left, Group Capt. R. G. Slade (right) with Sqn. Ldr. J. O. Mathews, D.S.O., D.F.C. (centre) and Mr. Ralph Munday.

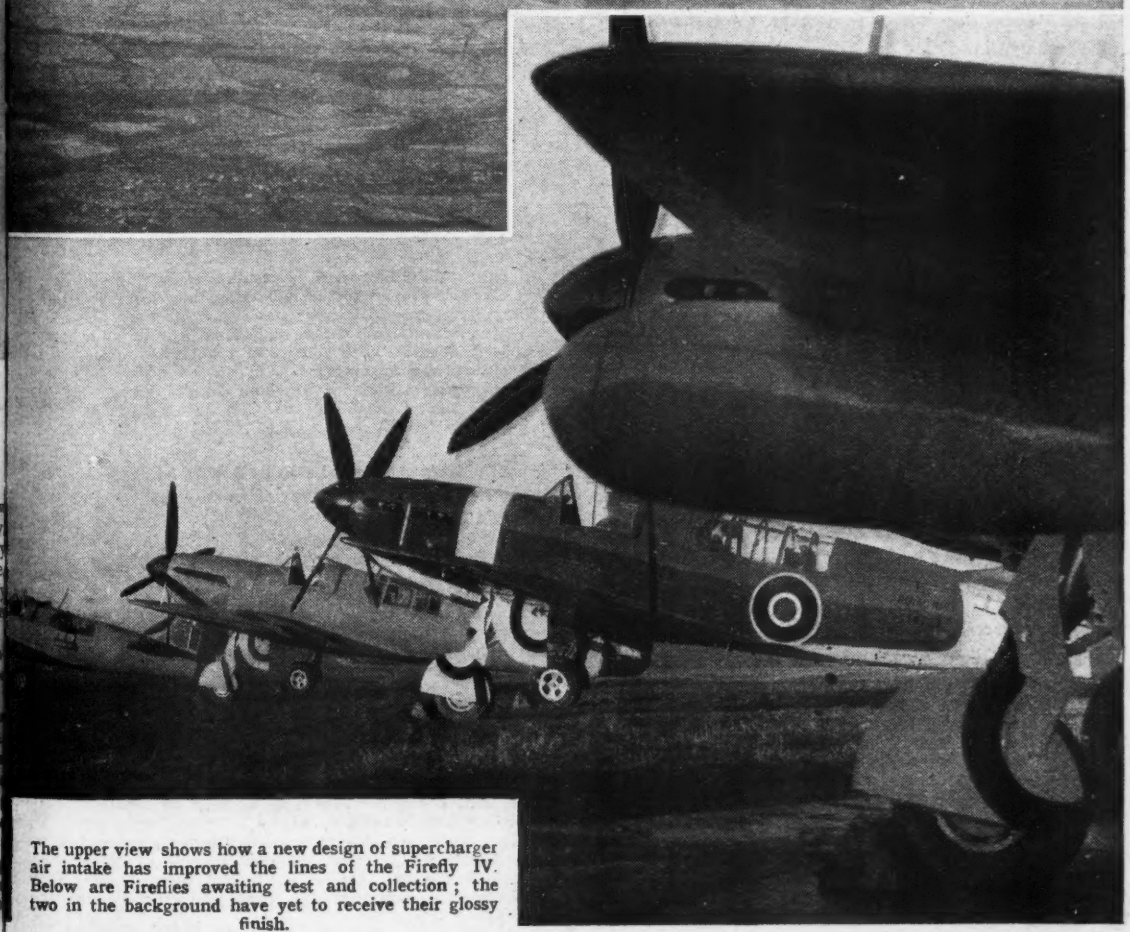
THE firefly (*lampyrida* or *elaterida*) derives its glow from a small abdominal organ. The Firefly (Fairey Fighter-Reconnaissance, Mk IV) is a luminary among Service aircraft because it combines performance, adaptability, handling qualities and load-carrying capacity in a degree hitherto unapproached in a carrier-borne aircraft.

Following the adoption of the Firefly IV by Naval Aviation, several countries have become interested or, like the Netherlands Government, have already placed orders.

New *Flight* photographs on these pages show that the latest version differs from its predecessors in nose design. The intake to the supercharger of the Rolls-Royce Griffon 74 engine is now immediately behind the spinner, *à la* Mustang, allowing a clean sweep of the bottom cowling line. All production aircraft, including those for the Netherlands, will have the new nose.

The testing of Firefly IVs is the responsibility of Group Capt. R. G. Slade, Fairey's chief test pilot, who is assisted at Heston by Lt. L. P. Twiss, D.S.C., and Sqn. Ldr. J. O





The upper view shows how a new design of supercharger air intake has improved the lines of the Firefly IV. Below are Fireflies awaiting test and collection; the two in the background have yet to receive their glossy finish.

FOR NAVAL NEEDS

Mathews, D.S.O., D.F.C. Sqn. Ldr. Mathews was a 100 Group night-fighter pilot and has lately joined the Company. The senior test pilot, Mr. S. M. Moseley, is at Ringway, where he serves the Stockport factory. Group Capt. Slade is further assisted by Mr. Ralph Munday (Heston Aircraft) and Mr. Tim Woods (General Aircraft).

In the normal sequence of production tests, each Firefly is initially flown without the radar nacelle and wing tank and in its undercoat of paint. After any necessary control adjustments the nacelles are installed and the machine is passed through the paint shop to receive its high-gloss finish before a final flight check.

The principal purpose of production-test flying is to check controllability and general airworthiness. At least 30 minutes must be spent in the air Special importance is attached to lightness of aileron control, but no large overbalance must occur at any speed. Trim adjustment must not exceed 1½ divisions throughout the speed range. Any necessary alterations to the "weight" of the ailerons are effected by altering the hinge heights, and a tendency to fly right- or left-wing low can be rectified by use of the trim-tab on the port aileron. Fixed metal strips on the top surfaces of the trailing-edge can be used together to correct any slight overbalance at maximum speed.

Elevators and rudder are tested for static friction and play in the operating system, and the Youngman high-lift aerofoil flaps, which retract to give an unbroken wing contour, must be tested at the maximum permissible air speed for each of the four settings—"housed," "take-off," "cruising," and "landing."

The power unit check embraces take-off boost and r.p.m., full-throttle climb and full-throttle level flight and maximum-cruising conditions. In addition, the undercarriage, fuel flow and all cockpit items are checked.

In a dive at an I.A.S. of 370 knots (the minimum acceptable, if weather does not allow this speed to be reached, is 350 knots), note is taken of control functioning, structural steadiness and vibration. Selected aircraft are stalled.

Good lateral control is considered particularly important on the Firefly because the addition of wing nacelles makes the ailerons somewhat heavier. Nevertheless, Fairey pilots have adequately demonstrated that even with the wing loads in place this eminently useful machine makes a fine showing against contemporary single-seaters.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

"CARRIER AT HOME"

Where the "Clockwork Mice" are Based

AS senior hand of the mess, I should like to refer to an error which was brought to my notice by members of the mess. This error appeared in *Flight*, October 31st, 1946, in the article headed "Carrier at Home," in which it was stated that Lossiemouth was the home of "The Clockwork Mice" squadron.

The members of the mess are highly indignant at this and wish to inform you that this squadron is flown from R.N.A.S. Milltown. W. TURNBULL.

[The information was gathered by the writer of the article during a visit to the *Theseus*.—ED.]

PILOTS' LICENCES

Whole Exam. System Needs Overhauling

IN your article on airline pilots' qualifications many interesting points are raised. Obviously a high standard must be maintained in the M.C.A. examinations for licences. Nobody objects to stiff exams. if they are practical and fair, but the particular objection of ex-R.A.F. pilots and navigators is that so much of the present syllabus is quite antiquated.

Legislation is an outstanding example, as most of it is based on 1919 agreements, and to have to remember such ancient equipment and procedure is laughable. Admittedly the examiners display considerable discretion in asking more modern questions, nevertheless the fact remains that the second year's syllabus, particularly, is out of date, but as long as it is still in force candidates must cover all the ground.

The prospective civil navigator is subjected to a deeper probe into his knowledge of air law than the pilot, though most of the points are the pilot's responsibility. Many are simply the concern of the airline operator and not the crew at all.

It is on such points that the ex-R.A.F. aircrew find it difficult to settle down to learn. The whole thing seems so futile. Why, for instance, should a landplane pilot or navigator have to learn dozens of complicated lights and signals used by ships? His studying time could be more usefully employed on vital knowledge.

While studying for the licences, frequent visits to the Ministry and Stationery Office are necessary to keep pace with the official mind, simply because the syllabus is not explicit and Notices to Airmen do not make sufficiently prompt announcements about new publications, etc.

By all means keep the standard high, but with practical and pertinent questions, not obstructive ones. The whole Ministerial machinery for the examinations and the Licence Department urgently need overhauling with a new policy of constructive help instead of obstruction.

OBSTRUCTION UNLIMITED.

A CHANCE TO FLY

For the Impecunious Enthusiast

I HEARTILY agree with Miss Ferguson's letter (*Flight*, December 12th) advocating the rebirth of the Civil Air Guard, since the impecunious enthusiast has seldom been catered for in this country.

A glance at my pilot's log book reveals a total of 10 hr 45 min flying time, all dual. The first half-hour is dated May, 1937, and the final half-hour was taken in May, 1946—nine years for ten hours dual!

I paid for the first three hours out of my wages of 10s. per week as an apprentice, the remaining time being paid for out of my pay as an A.C.2 in the Royal Air Force. This dual cost £2 per hour, and I also had to pay considerable sums for club membership, with the result that I had to forgo every other form of entertainment.

The present charge of £3 per hour is quite beyond my slender purse, but am I downhearted? No, just a little more determined to get that "A" licence! PHILIP D. TREVOR.

ULTRA-LIGHT AIRCRAFT

C. of A. for Gliders Next

FORMERLY one would have advised E. J. Pope and T. N. Walker (*Flight*, December 5th), to join a gliding club, where they could get flying free from red tape. But now gliders also are promised compulsory C.'s of A. under regulations not yet finalized, and maintenance by "M" licence (glider) engineers, who are not yet appointed. What is the use of beginning to build a machine if these regulations will prevent its being flown? Or is there to be a subsidy to cover the extra expense?

It ought to be realized that almost any machine with a wing loading of less than about 5 lb/sq. ft is safe because it can land in any small field, and for these there should be a minimum of regulations. The A.R.B. should concentrate on heavy machines and those which carry trusting passengers. Light aircraft accidents are very seldom serious and almost never involve third parties, and few would be avoided by regulations, since faults are usually operational.

What, then, is the purpose of this fatherly interest of those in authority? Do pilots suddenly become of extreme value when a war ends? Or has the safety record of light aircraft pilots been so bad that they need protecting against themselves? J. A. ALLAN.

One of the most beautiful aircraft ever built, the prototype Spitfire "K5054" attained 349.5 m.p.h. The Griffon-powered Seafire 47 (lower view) does 452 m.p.h.

Spitfire and Seafire

Their Development Described by Supermarine Chief Designer

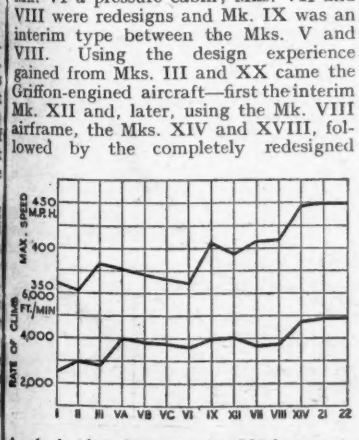
THE evolution of the Spitfire and Seafire was the topic of a paper delivered before the Royal Aeronautical Society on December 19th by Mr. J. Smith, C.B.E., F.R.Ae.S., A.M.I.A.E., Chief Designer to Vickers-Armstrongs, Ltd., Supermarine Works. Mr. Smith said that over 22,000 of these aircraft, in thirty-three different types were produced.

Having referred to the early development of Supermarine high-speed aircraft and mentioned the F.7/30, with Goshawk engine, Mr. Smith described the development of Spitfires, Mks. 1 to 24, which can be summarized as follows: Mks. I, II and V had Merlin engine changes; Mk. VI a pressure cabin; Mks. VII and VIII were redesigns and Mk. IX was an interim type between the Mks. V and VIII. Using the design experience gained from Mks. III and XX came the Griffon-engined aircraft—first the interim Mk. XII and, later, using the Mk. VIII airframe, the Mks. XIV and XVIII, followed by the completely redesigned Mks. 21, 22 and 24. Features of each Mark are given in detail in the tables.

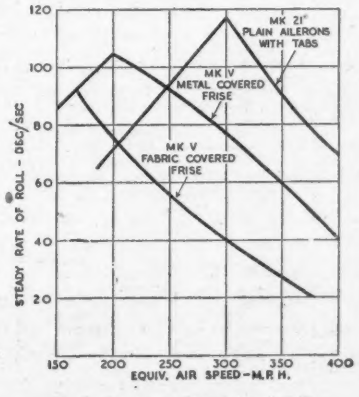
	Spitfire I	Seafire 47
Weight, normal	5,820 lb.	10,300 lb.
Weight, overload	—	12,500 lb.
Wing area	242 sq. ft.	244 sq. ft.
Wing loading	24 lb./sq. ft.	42.2 lb./sq. ft.
Maximum horse power	1,050	2,350
Power plant weight	2,020 lb.	3,650 lb.
Maximum speed	362 m.p.h.	452 m.p.h.
Maximum rate of climb	2,500 ft./min.	4,800 ft./min.
Time to 20,000ft.	9.4 minutes	4.8 minutes
Weight of fire/sec.	4.0 lb.	12.0 lb.
Fuel capacity, internal	85 gallons	154 gallons
Range including allowance for take-off climb and 15 minutes combat...	395 miles	405 miles
Maximum range	575 miles	1,475 miles
Rate of roll at 400 m.p.h.	14.0 degrees/sec.	68 degrees/sec.
Permissible C.G. range, percentage mean chord	2.7	11.5
Factored wing loading	240 lb./sq. ft.	464 lb./sq. ft.
Maximum diving speed	450 m.p.h.	500 m.p.h.
Structure weight, per cent.	33.0	31.0
Energy absorption of undercarriage	8,300 ft./lb.	26,600 ft./lb.
Undercarriage stroke	4.9 inches	9.0 inches

Mr. Smith referred to the continuous increase in power available and the efforts of Rolls-Royce which resulted in more than doubling engine power—from a maximum of 1,050 h.p. on the Spitfire I to 2,350 on the Seafire 47. The fact that such an enormous increase was accommodated without material alteration in the size of the aircraft constituted one of the main achievements and was only accomplished by the closest co-operation. It was found, when the fitting of the Griffon engine to the Spitfire IV was investigated in 1939, that several parts protruded through the side of the fuselage. These were redesigned by Rolls-Royce to bring them inside the Spitfire's lines. Increased power necessitated increased cooling, culminating, on the introduction of the two-stage engine, in the use of duplex radiators, one combining glycol and oil coolers, and the other glycol and intercoolers.

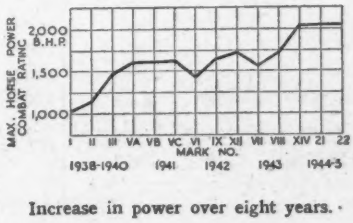
The following figures were quoted for improvement in speed (m.p.h.) given by various refinements: retractable tail wheel, 5; airscrew root fairings, 4; undercarriage door panel, 3; whip aerial, 0.5; plain ailerons, 6; curved windscreen, 6; multi-ejector exhausts, 4; improved finish and wax polish, 9;



Analysis of performance for Marks 1 to 22



Typical curves for rate of roll.


MAX. HORSE POWER COMBAT RATING
2,000 B.H.P.
1,500
1,000
I II III VA VB VC VI IX XII VII VIII XIV 21 22
MARK NO.
1938-1940 1941 1942 1943 1944-5

Increase in power over eight years.

SPITFIRE AND SEAFIRE

clipped wing tips, 1; rear-view hood and deletion of mirror, 1.

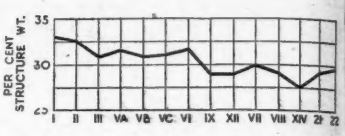
In changing to the Griffon engine, the opportunity was taken to drop the nose, giving an improved shape to the forward part of the machine and slightly improving the view.

Control

The problem of "feel" and ease of control over a wide speed range was not easy, but there is little doubt that the Spitfire set a new high standard in this respect. As development proceeded, and fighting experience became available, efforts were made to improve control. Aileron control first received attention. Although very effective at low and moderate speeds, it was found to become heavy and less responsive when during combat pilots dived the Spitfire to its limit. Stick forces and rate of roll were measured, and the results are given in the graph on page 707.

As operational speeds increased further the effect of torsional stiffness of the wings on aileron effectiveness became a serious factor, and in designing the wing of the Mk. 21 a theoretical reversal speed of 825 m.p.h. was catered for, against 580 m.p.h. with earlier types. An increase in wing stiffness of 47 per cent was obtained by ensuring rigid load-carrying joints at all points of access to the torsion box, and by increasing the gauge of wing plating and modifying the structure at various points.

Careful analysis on various marks revealed fairly wide variations in aileron section and in the position of the ailerons relative to the wings. These differences resulted in inconsistent aileron characteristics, and ailerons of a type which would be simple to manufacture and which would be less sensitive to manufacturing tolerances were considered necessary.



Variation of percentage structure weight

Quantitative data obtained from flight trials on a Spitfire V with plain ailerons

TABLE I

Mark	Engine	Engine mounting	Airscrew	Engine cowling	Air intake	Exhaust manifold	Radiator type and frontal area	Intercoolant radiator	Oil cooler and area
Ia, Ib	Merlin II or III	Tubular	2-posn. D.H. 3-blade 2-blade fixed pitch or 3-blade D.H. c.s.	Sectional, quick-release fasteners	Temp.	Triple ejector plain or fish tail ends	1.88 sq ft or QA, 1.85 sq ft	—	0.2 sq ft
II	Merlin XII	Tubular	3-blade Jablo Rotol c.s.	do	do	do	do	—	0.35 sq ft
III	Merlin XX	Tubular, extended Mk. I	3-blade Jablo Rotol	do	do	do	WS, 6450 1.45 sq ft	—	0.35 sq ft
Va, Vb	Merlin 45 series	As Mk. I	3-blade Rotol c.s. or 3-blade D.H. bracket or hydromatic type	do	Temp. or trop.	do	QCV, 1.88 sq ft or QCY, 2.04 sq ft	—	do
Vc and trop.	Merlin 45 series	As Mk. I	do	do	Temp. or trop.	do	do	—	do
VI	Merlin 47 series	As Mk. I	4-blade Jablo Rotol	do	Temp.	do	QCV, 1.88 sq ft	—	do
VII	Merlin 61 series	Tubular, extended	Rotol 4-blade Hydulignum	Extended and louvred for Marshall blower	Temp.	Multi-ejector	Two QCP, each 1.24 sq ft	QCR 0.72 sq ft	QCQ 0.6 sq ft
VIII	Merlin 61 series	do	do	Extended	Trop.	do	do	do	do
IX	Merlin 61 series	do	do	do	Temp. or trop.	do	do	do	do
XII	Griffon III or IV	Built-up box members	4-blade Jablo Rotol	Blistered over cylinders	Temp.	do	QCY, 2.04 sq ft	—	0.35 sq ft
XIV	Griffon 65	As Mk. XII extended	5-blade Rotol	Amal type fasteners	Trop.	do	QFG and QFJ each 2.45 sq ft	QFH 2.45 sq ft	QFK 2.45 sq ft
XVI	Merlin 266	Tubular, extended. As Mk. IX	4-blade Rotol	Extended as Mk. IX	Temp. or trop.	do	Two QCP each 1.24 sq ft	QCR 0.72 sq ft	QCP 0.6 sq ft
XVIII	Griffon 65	Extended Mk. XII	5-blade Rotol	Amal type fasteners	Trop.	do	QFG and QFJ each 2.45 sq ft	QFH 2.45 sq ft	QFK 2.45 sq ft
21	Griffon 61 or 64	Built-up box members, as Mk. XVIII	5-blade Rotol	do	Trop.	do	QEW and QEY each 2.45 sq ft	QEV 2.45 sq ft	QEZ 2.4 sq ft
22	Griffon 61 or 64	do	do	do	Trop.	do	QGD and QGE each 2.45 sq ft	QGC 2.45 sq.ft	QGF 2.45 sq ft
24	Griffon 61 or 64	do	do	do	Trop	do	do	do	do
Seafire I	Merlin 45, 50, 55, 46, 50A or 56	Tubular	As Spitfire Va	Sectional, quick-release fasteners	Temp. or trop.	Triple ejector, plain or fish-tail ends	QCY, 2.04 sq ft	—	0.347 sq ft S.799-3C-528R
Seafire II	Merlin 32, 45 or 46	do	4-blade Rotol	do	do	do	do	—	do
Seafire III	Merlin 45, 50, 55, 46, 50A or 56	do	do	do	do	do	do	—	do
Seafire XV	Griffon VI	Built-up semi-cantilever beam	4-blade Rotol	do	Trop.	Multi-ejector	QCP, 1.24 sq ft QCV, 1.85 sq ft	—	QCQ 0.6 sq ft
Seafire XVII	Griffon VI	As Seafire XV	do	do	Trop.	do	do	—	do
Seafire 45	Griffon 61	do	5-blade Rotol	Extended with Amal type fasteners	Trop.	do	QGD and QGE each 2.45 sq ft	QGC 2.45 sq ft	QGF 2.45 sq ft
Seafire 46	Griffon 87	do	2-3-blade Rotol contra-rotating	do	Trop.	do	do	do	do
Seafire 47	Griffon 87	do	do	do	Trop.	do	do	do	do
PR. IV	Merlin 45, 46, 50, 55A, 55 or 56	Tubular	3-blade D.H. c.s.	Sectional, quick-release fasteners	Temp. or trop.	Triple ejector	QCY 2.04 sq ft	—	0.347 sq ft S.799-3C-525R
PR. VII	Merlin 45 or 46	do	do	do	Temp.	do	QCV 1.85 sq ft	—	do
PR. X	Merlin 64	Extended tubular	4-blade Rotol c.s.	Extended	Trop.	Multi-ejectors	Two QCP each 1.20 sq ft	QCR 0.714 sq ft	QCQ 0.6 sq ft
PR. XI	Merlin 61, 63, 63A or 70	Extended tubular	4-blade Rotol hydulignum	Extended	Temp. or trop.	do	do	do	QCR 0.6 sq ft
PR. XIII	Merlin 32	Tubular	3-blade D.H.	As PR. VII	Temp.	Triple ejector	QCV 1.85 sq ft	—	0.347 sq ft S.799-3C-525R
PR XIX	Griffon 65 or 66	Built-up semi-cantilever beam	5-blade Rotol c.s.	Extended, with Amal type fasteners	Trop.	Multi-ejector	QFJ and QFG each 2.46 sq ft	QFH 2.46 sq ft	QFK 2.46 sq ft

All radiators commencing with type letter "Q" by Morris, all others by Serck. Temp. = Temperate; Trop. = Tropical.

SPITFIRE AND SEAFIRE

fitted with a balance tab had previously indicated that aileron properties comparable with those of a metal-covered Frise type could be achieved, with a reduction in drag due to the elimination of the gap. Ailerons of this type, with area increased to 6 per cent of the total wing area, as against 5 per cent on earlier marks, were fitted to the stiffer Mk. 21 wing and gave a high rate of roll with reasonable stick forces at high speeds.

Fire Power

The original armament of eight .303in Browning guns, with 300 rounds of ammunition was good for its time, but the need for the greater hitting power of the 20 mm Hispano gun soon became apparent. The Spitfire wing had to be redesigned to accommodate one of these weapons on each side and four of the Brownings were retained outboard. The Browning and Hispano guns could be fired together or separately.

Only 60 rounds of 20 mm ammunition could be carried, as the drum-type magazine was the only one available. This drum also necessitated the fitting of blisters to the wing surfaces. Wings for two Hispanos and four Brownings were known as Type "C." The next step was the type "C," or universal wing. Eventually belt feed became available, increasing ammunition capacity to 160 rounds per gun. The next change was the fitting of two .5in Browning guns instead of the four .303in guns, together with two 20 mm Hispanos.

Four 20 mm guns were made standard on Mks. 21, 22 and 24, together with the provision of 140 rounds per gun. The bulky blisters stayed to the end in spite of design efforts on the firm's part.

Range

The Spitfire was originally designed as an interceptor operating from home bases. Its fuel capacity of 85 gallons only allowed for take-off, a climb to altitude, 1.65 hours cruising and 15 minutes combat. In the final fighter version the petrol capacity was approximately double that of the original and the fighting range was actually increased, a feat which required some ingenuity as the size of the aircraft remained virtually constant.

The steps taken were: the expansion to the limit of space of the original main tanks, followed by the introduction of fabric tanks in the leading-edges of the wings, the use of subsidiary tanks in the fuselage immediately aft of the pilot's cockpit, and the use of drop-tanks.

Structural Efficiency

Obviously, as power and speed increased the loads to be carried became greater. The resulting problems were solved mainly by the use of materials of higher strength than those originally used, and by the local application of thicker sections.

The main spar booms, which consisted of a series of duralumin tubes telescoped inside each other and stopped off at intervals, lent themselves to modification in two ways. First the relative lengths of tubes were increased, and later, the material of the tubes was changed from T.4 to DTD. 273, a higher grade light alloy. The final development, used on the Mark XVIII aircraft, was the use of an ex-

TABLE II

Mark	Span ft in	Wing Area, sq ft	Wing tips	Armour lb	Armament
I, A and B	36 10	242	S.	—	Mk. IA — 8 B., Mk. IB — 4 B., 2 H.
II, A and B	36 10	242	S.	73	As above
III	30 6	220	C.	88	8 B., 4 B.
	36 10	242	S.	88	and 2 H., 8 B., or 4 H.
VA	36 10	242	S.	129	8 B., 2 H.
VB				152	and 4 B.
VC	36 10	242	S.	193	Universal
VI	40 2	248.5	E.	152	2 H. and 4 B.
VII	40 2	248.5	E.	202	do
VIII	36 10 or 40 2	242 or 248.5	S.	202	2 H. and 4 B., or 4 H.
IX	36 10	242	S.	202	2 H. and 4 B.
XII	32 7	231	C.	180	do
XIV	36 10 or 32 7	242 or 231	S. or C.	180	do
XVI	36 10	242	S.	202	2 H. and 2 0.5in B.
XVIII	36 10 or 32 7	242 or 231	S. or C.	180	do
21	36 11	244	Special Mk. 21	190	4 H.
22	36 11	244	Mk. 21	190	do
24	36 10	244	Mk. 21	190	do
Seafire I	36 10	242	S.	161	2 H. and 4 B.
Seafire II	36 10	242	S.	202	do
Seafire III	36 10	242	S. folding	202	do
Seafire XV	36 10	242	As Mk. III	180	do
Seafire XVII	36 10	242	As Mk. III	164	do
Seafire 45	36 11	244	Mk. 21 Non-folding	190	4 20 mm. H.
Seafire 46	36 11	244	As Mk. 45	190	4 20 mm. H.
Seafire 47	36 11	244	As Mk. 45, folding	190	4 20 mm. H.
PR. IV	36 10	242	S.	85	—
PR. VII	36 10	242	S.	129	8 B.
PR. X	36 10	242	S.	85	—
PR. XI	36 10	242	S.	85	—
PR. XIII	36 10	242	S.	152	4 B.
PR. XIX	36 10	242	S.	85	—

S = Standard, C = Clipped, E = Extended, B = Browning Guns, H = Hispano Guns.

TABLE III

Mark	Fuselage	Windscreen	Tail-wheel	Undercarriage
I	Light alloy monocoque	External bullet-proof screen or plain Perspex	F.	Outwardly retractable oleo unit
II	do	do	do	do
III	Strengthened	Internal bullet-proof screen	R.	Strengthened and wheel moved 2in forward
V, A and B	As Mk. I with reinforced longerons	do	F.	As for Mk. I
VC	do	do	F.	As for Mk. III
VI	Pressurised cabin. Bulkheads fore and aft of cabin	Special non-sliding hood	F.	As for Mk. VC
VII	Basically Mk. VI strengthened to take increased engine loads	Double-glaze sliding	R.	do
VIII	Strengthened	As Mk. V	R.	do
IX	As Mk. V, strengthened	As Mk. V	F.	do
XII	Mk. V strengthened, with attachments at Fr. 5 for Griffon engine	do	F., later R.	do
XIV	Mk. VIII strengthened, attachments for Griffon engine	do	R.	do
XVI	As Mk. V	As Mk. V	F.	do
XVIII	Mk. VIII still further strengthened	As Mk. XIV	R.	As Mk. V, strengthened
21	Redesigned for increased loads	do	R.	Strengthened and extended. Fairing flaps fitted
22	As Mk. 21	Rear vision hood	R.	As Mk. 21
24	do	Rear vision hood	R.	do
Seafire I	Light alloy monocoque. Arrester hook and slinging points	Internal bullet proof	F.	Outwardly retractable oleo unit
Seafire II	As Mk. I with reinforced longerons. Arrester hooks, slinging points and catapult spools	do	F.	Strengthened
Seafire III	As Seafire II	do	F.	As Seafire II
Seafire XV	As Seafire II, strengthened. Later a/c, had sting hooks	do	R.	do
Seafire XVII	As Seafire XV with sting hook and accelerator hooks	Rear view hood, curved screen	R.	As Seafire XV with long-stroke oleo legs
Seafire 45	As Spitfire Mk. 21 with sting hook	As Seafire XV	R.	As Spitfire Mk. 21
Seafire 46	As Spitfire Mk. 22 with sting hook	As Spitfire Mk. 22. Rear view hood, flat screen	R.	As Seafire 45
Seafire 47	As Mk. 46. Accelerator hooks	Rear view hood, curved screen	R.	Strengthened and long-stroke oleos
PR. IV	Light alloy monocoque with camera installation	Plain perspex	F.	Outwardly retractable oleo unit
PR. VII	do	Internal bullet-proof	F.	do
PR. X	Pressure cabin	As Spitfire Mk. VII (F)	R.	do
PR. XI	Special PR type for universal camera installation	Plain perspex	F., later R.	do
PR. XIII	As Mk. I with reinforced longerons	Internal bullet-proof	F.	do
PR. XIX	Pressure cabin	As Spitfire Mk. VII(F)	R.	do

N.B.—PR. IV, VII and XIII carry 2 vertical F.24 and 1 oblique F.24 cameras; Mk. X, XI and XIX, universal
F = Fixed, R = Retractable.

SPITFIRE AND SEAFIRE

truded section in DTD. 364 machined on the taper. This was not used on the Mk. 21 because of production considerations.

The stressed skin construction permitted strengthening by increasing the gauge of the skin covering. The final stages required the use of steel longerons in the fuselage and steel reinforcements for the centre-section spar booms.

Special Duties

Normal Service use called for special jobs and many of the later marks of Spitfire had three variations: the standard aircraft, known as "F," fitted with a medium-altitude-rated engine; the "H.F." type with a high-altitude engine and increased wing span; and the "L.F." type, for low-altitude work. Three types of wing were available, known as standard, extended or clipped, allowing a total variation of wing span of 7ft 7in, or 23 per cent. Still another type of machine known as the "F.R." had a low-altitude engine, normal armament and increased fuel capacity.

Various combinations of cameras were installed, and a universal camera installation finally adopted. Armed versions for low-altitude work were also introduced.

No fighter existed in which the average pilot could patrol and fight at 40,000 feet so it was decided to pressurize the cockpit, and the matter being one of great urgency, a prototype was constructed by direct modification of a completed Vb aircraft. It was fitted with a special high-altitude Merlin 47 engine incorporating a Marshall cabin blower capable of producing 90 cubic feet of air a minute.

The major problem was to render the cockpit sufficiently airtight, and this was accomplished by the fitting of bulkheads fore and aft, while a special airtight hood replaced the sliding one. On the resulting aircraft a cabin pressure of 2 lb/sq. in. was attained, which reduced the apparent altitude from 40,000 to 28,000 feet.

During the Norwegian campaign, the firm was asked to convert a Spitfire to a seaplane to permit operation from sheltered waters. A Spitfire I was used, and as time was limited Blackburn Roc floats were fitted, which did not lend themselves at all well to adaptation. A machine was completed, but because of the early termination of the Norwegian campaign and the urgency of providing aircraft for the Battle of Britain, the machine was reconverted to standard before it flew. The requirement was not allowed to drop, and in 1942 a second float-plane was produced, built around the Mk. V. Subsequently a Mk. IX was converted, using the same design of float, and a few of these conversions were manufactured.

Mr. Smith then referred to the Spitfire Trainer, already familiar to readers.

Naval Problems

Towards the end of 1941 a Spitfire Vb was fitted with an arrester hook in the form of an A-frame hinged to the underside of the rear fuselage. Another machine, this time a Vc, was similarly treated and given catapult spools. A number of both types were built, but their successful operation from carriers raised the much greater problem of wing folding.

The folding of such a thin wing presented apparently insoluble problems, if excessive weight increase and loss of stiffness were to be avoided. Finally it was found possible to introduce two straight fore-and-aft folds. The increase in weight was only 125 lb and the decrease in torsional rigidity was 10 per cent.

Deck-landing characteristics were improved by fitting a new form of arrester hook known as the sting hook which cut down the moment about the C.G. and considerably improved the deck-landing characteristics of the machine.

On the Seafire XVII, a rear-vision hood was incorporated, also an undercarriage giving greatly improved shock-absorbing characteristics. Another feature brought in on this type was the curved front for the pilot's windscreen, achieved by fixing a curved plate glass panel in front of the bulletproof screen.

Conversions of the latest type of Spitfires are now being produced for the Royal Navy. The basic type used is the 21 series, and the latest naval versions incorporate such features as contra-rotating airscrews, increased flap areas and long-stroke undercarriages.

Mr. Smith concluded by pointing out that aircraft design has become a very complicated business, and that a chief designer has to rely very much on his specialists. "I have been very fortunate," he said, "in having a very loyal and capable staff who worked with enthusiasm."

Sir Frederick Handley Page was in the chair, and asked Mr. Smith if it would be possible to give, in an appendix to the paper, a more detailed account of the reasons for the changes made and, more particularly, some information about the troubles and failures which must have occurred, the causes of the failures, and the remedies applied. That was the sort of information which was of great value to other designers. He would also like to see corresponding figures for the Hurricane so that comparisons could be made.

A question asked during the discussion revealed that the manufacturers of wheels and tyres had also contributed to the success by producing tyres of the same size which would withstand much higher pressures.

He agreed with Sir Frederick that information about failures was more instructive than accounts of success, and said he would see if the material could be collected together. That, however, would be a fairly big task, and the result would be somewhat lengthy.

TABLE IV

Mark	Ailerons	Rudders	Elevators
I	Frise type fabric covered	Horn-balanced, fabric covered	Light alloy, fabric covered
II	do	do	do
III	do	do	do
VA and B	do, metal covering later	do	do
VC	do	do	do, on early a/c later, extended horn
VI	do	do	As Mk. I
VII	Reduced span	Large chord increased area	E. horn balance
VIII	do	do	do
IX	As Mk. VC	do	do. Metal covered later
XII	do	do	As Mk. I
XIV	As Mk. VIII	Increased area, fin and rudder	E. horn balance
XVI	As Mk. VC	As Mk. VII	E. horn balance, metal covered
XVIII	As Mk. VIII	Increased area, fin and rudder	E. horn balance
21	Plain, balance tab. Extended span	do	Extended balance, rounded-horn
22	do	Further increase area, fin and rudder	Increased area, tail plane and elevator
24	do	As Mk. 22	As Mk. 22
Seafire I	Frise type, metal covered	Horn-balanced, fabric covered	Light alloy, metal covered
Seafire II	do	do	do, later extended horn. Metal covered
Seafire III	do	do	do
Seafire XV	do	Large chord rudder as Spitfire Mk. XII	do
Seafire XVII	do	do	do
Seafire 45	Plain ailerons, geared tabs	Horn-balanced, fabric covered. Increased area as Spitfire Mk. XIV(F)	Metal covered, rounded extended horn
Seafire 46	As Seafire 45	Fabric covered, increased area as Spitfire Mk. 22(F), horn balanced with anti-balance trimmer tab	Increased area. Metal covered
Seafire 47	do	As Seafire 46	As Seafire 46
PR. IV	Frise type, metal covered	Horn-balanced, fabric covered	Light alloy, fabric covered. Extended horn
PR. VII	do	do	do
PR. X	do	Increased area as Spitfire Mk. XII (F)	do
PR. XI	do	do	do
PR. XIII	do	As PR. IV	do
PR. XIX	Reduced span	Horn-balanced, fabric covered. Increased area as Spitfire Mk. XIV	do

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THE LITTLE DIFFERENCE: In this unusually attractive Spitfire formation picture the leader's aircraft is a Mk. XXII and the wing machines Mk. XXIs. Mr. J. Smith, Supermarine designer, discusses Spitfire development on pages 707-710.

Royal Air Force and Naval Aviation News and Announcements

U.S. of S. Visits Germany

THE Under-Secretary of State for Air, Mr. Geoffrey de Freitas, left London on December 12th for a short tour of Royal Air Force Units of British Air Forces of Occupation in Germany.

Recruiting Extension for R.O.C.

MEN and women who served in the Royal Observer Corps during the war and then joined the Forces may now volunteer for the peacetime R.O.C. Recruiting has hitherto been confined to those who were serving at the "stand-down" in May, 1945, and then stated their willingness to re-join.

Chaplain-in-Chief Returns

THE REV. J. A. JAGOE, C.B.E., D.D., K.H.C., Chaplain-in-Chief to the R.A.F., has now returned from a tour of overseas R.A.F. Stations, during which he visited Palestine, Aden, Khartoum, Nairobi and Salisbury, Southern Rhodesia. He was able to study at first hand the problems of his Chaplains and his visit to Southern Rhodesia was especially important as in the New Year the R.A.F. begins training pilots and navigators there.

On Remembrance Day at Nairobi he attended the ceremonial parade in the morning, and in the evening fulfilled a long-standing engagement, when he preached at the Cathedral. During his tour he visited the Bishops of Khartoum, Mombasa and Southern Rhodesia.

Awards

THE KING has been graciously pleased to give orders for the following appointments to the Most Excellent Order of the British Empire:—

To be Additional Members of the Military Division of the said Most Excellent Order:—

Acting Sqn. Ldr. Laurence Reavell-Carter, R.A.F.V.R., No. 49 Squadron.

Flt. Lt. Sidney Maurice Garlick, R.A.F.V.R., No. 12 Squadron.

Flt. Lt. James Edwin Thompson, R.A.F.V.R., No. 58 Squadron.

W/O. Victor Rodney Jacob Slaughter, R.A.F.V.R., No. 405 Squadron.

The King has been graciously pleased to approve the following Royal Air Force award:—

Distinguished Flying Cross.

Flt. Lt. Alan Martin Smith, R.A.F.V.R., No. 48 Squadron.

Royal New Zealand Air Force.

P/O. Noel Callan Sharp, R.N.Z.A.F., No. 243 Squadron.

Ex-Naval Pilots and University Squadrons

ALTHOUGH the Air Ministry, in announcing recruiting for the University Air Squadrons, stated that ex-members of Services other than the R.A.F. were excluded from the scheme because of liability to recall to their own Services, it may now be announced that the Admiralty have already released, at the officers' request, a number of ex-Naval pilots from their R.N.V.R. liability in order that they might join the R.A.F.V.R. This is particularly true in cases where the applicant had originally joined the R.A.F. and subsequently transferred to Naval Aviation.

It is necessary for each individual concerned to make written application to the Admiralty for release. Each case will be decided on its merits.

The question of providing means at the Universities for ex-R.N.V.R. pilots to keep in flying practice, under R.N.V.R. *ægis*, is now being considered by the Admiralty, who hope to reach a decision very soon.

69 Squadron in Berlin

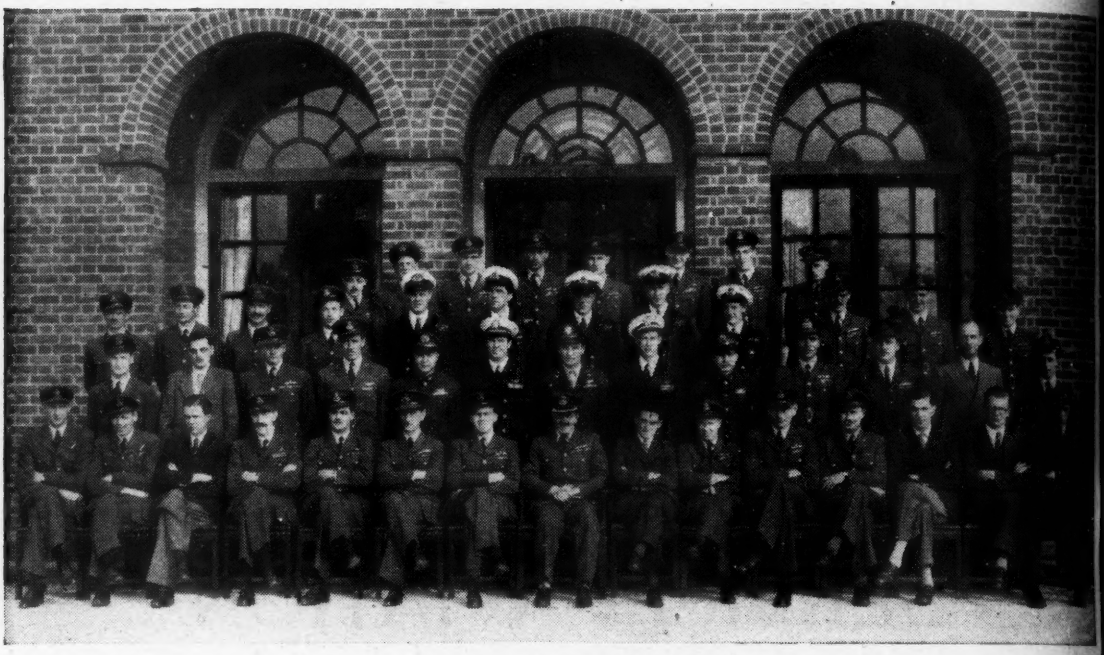
THE honour of being the first Mosquito squadron to be based in Berlin has fallen to No. 69 Squadron, commanded by Wing Cdr. W. P. Kemp, D.S.O., D.F.C. Equipped with Mosquito XVIs the squadron is expected to stay at Gatow until the end of December.

Last March it took part in the London-Nuremberg courier service and continued throughout the duration of the trial. Its "home base" is at No. 139 Wing, Wahn, near Cologne.

Selected R.A.F. squadrons are based in Berlin in turn, for short periods.

Guided Projectiles Range

SUBJECT to a satisfactory agreement between the two Governments on the financial and other aspects of the undertaking, the Australian Government have

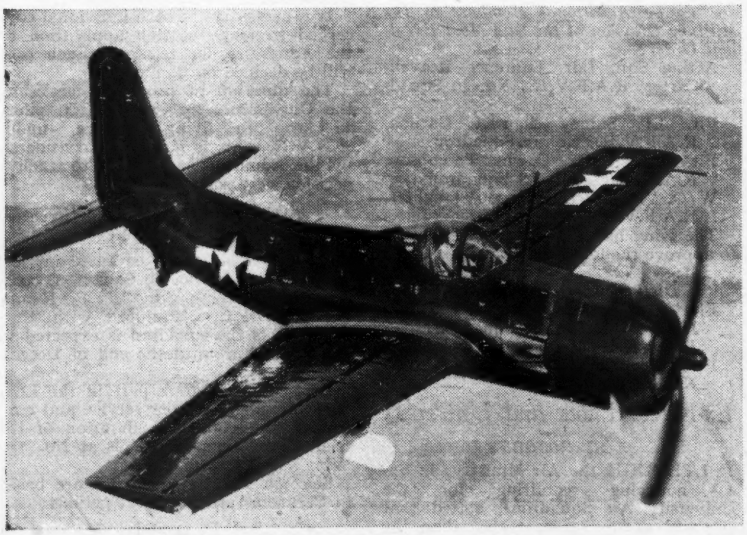


FIFTH COURSE: The Commandant, Group Capt. H. J. Wilson, O.B.E., A.F.C., instructors and pupils of the fifth course at the Empire Test Pilots' School, Cranfield. On the Commandant's left is the chief technical instructor, Mr. G. MacLaren Humphreys and on his right the O.C. Flying, Wing Cdr. R. L. Smith.

SERVICE AVIATION

accepted the United Kingdom Government's proposal that a firing range and associated technical facilities should be set up in Australia for experiments with guided projectiles and other long-range weapons.

Lt.-Gen. J. F. Evetts, who headed the Mission which visited Australia in April, 1946, is returning to Australia, accompanied by a small technical staff, to collaborate with the Australian authorities concerned in the detailed planning and execution of the project.



ONE, OCCASIONAL TWO: The 18,000 lb. XBT2C-1 experimental torpedo-bomber (fan-cooled Wright R-3350), built by Curtiss-Wright for the U.S. Navy, is normally manned by the pilot only, but for special radar "scouting" carries a second man. A large rocket can be carried in the bomb-torpedo bay.

FOREIGN SERVICE NEWS

The Promising Prentice

DURING the last week of the Paris Aero Show, Air Attachés of several nations visited the Percival stand in company with the British Air Attaché in Paris. They subjected the Prentice—the new three-seat trainer for the R.A.F.—to the closest scrutiny, and as a result the Greek, Netherlands, Czechoslovak and other Governments are considering the adoption of this machine for their air forces. The Czech Government, incidentally, are interested in the possibilities of the Prentice for survey work.

Jet Bomber Prototype

TWO Rolls-Royce Derwents are the proposed power units of the Nord 1601 tandem two-seater with swept-back wing. Weighing over 13,000 lb, this machine should attain about 580 m.p.h. at 39,000ft and have an endurance of over two hours at economical speed. It will be regarded as a prototype of future bombers.

Guided Missile Responsibility

WITH a view to averting rivalry between the U.S. Air Forces and the Ordnance Dept., the War Department has made the Army Air Force primarily responsible for the development of guided missiles. Counter-measures and associated items of equipment are also the A.A.F.'s concern.

A "referee"—Major-General H. S. Aurand—will decide disputes as to what constitutes a guided missile.

Russia's Jet Interest

THERE is reason to believe that the Soviet Air Force is particularly interested in the designs of the Junkers E.F.130 four-jet bomber and the E.F.128 single-jet fighter. The E.F.130 is of flying-wing design and was intended for four Heinkel-Hirth 011 jet units. With a span of about 80ft, it was to attain speeds of the order of 600 m.p.h. Likewise of tailless design, the E.F.128 had been mocked-up when the Germans collapsed. This weighed 10,000-11,000 lb.

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